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LEUCOPLAKIA OF THE URINARY ORGANS[1, 2]

A REPORT OF THIRTEEN NEW CASES

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LEUCOPLAKIA of the urinary organs has until quite recently received but scant attention in American literature. A number of very interesting cases have been reported within the past few years by authors who have very carefully brought the literature up to date. I refer especially to the recent publications by Briggs and Maxwell, Cumming, Hennessey, Hinman, Kutzman and Gibson, Valentine, Wilhelmi, and Young.

Most of these articles deal with the cases in which the condition affected the urinary bladder, the ureter, or the kidney pelvis. Leucoplakia of the urethra is not so common; at least this is the impression which has been gathered from a more or less casual perusal of the literature.

In two previous publications I reported three cases. In two cases the kidney pelvis was the seat of the disease and in one, the urinary bladder and the ureter were involved. Since the publication of these papers, articles have appeared in the European literature by Allemann, Broglio, Cirillo, Corsdress, Jura, Livirghi, Pedroso, and von Borza.

In this paper no attempt will be made to review the literature because this was done in one of my earlier papers as well as in some of the papers mentioned. Hennessey's paper, published in January, 1927, shows a total of 79 cases reported in the literature. This with the 13 cases which I shall describe makes a total number of 92 cases which have been reported to date.

In 7 cases, the bladder was affected; in 3 the urethra; in 2 the kidney pelvis; and in 1 a kidney pelvis and ureter were affected.

The various theories regarding the pathogenesis have been reviewed so many times in recent publications that they will not be considered in this paper. Those who are interested in the theories, as well as in the rôle played by the presence of tuberculosis, chronic infection, and stone, may refer to these articles.

SEX

In a previous study of the subject of leucoplakia in which an extensive review of the literature was made, we found 34 cases in males, 8 cases in females, and 2 cases in which the sex was not stated. In the present series, there are 9 males and 4 females.

In a recent review of 75 cases, Hennessey found that this lesion occurred in the male 56 times and in the female 19 times, a ratio of practically 3 to 1. Hinman, Kutzman, and Gibson, in their paper, stated that at least in the kidney pelvis, the incidence was equal in the two sexes.

AGE

Age probably has no etiological significance. Table I shows the distribution in our series.

[1] Read at the annual meeting of the American Association of Genito-Urinary Surgeons, Washington, April 30, May 1 and 2, 1928.
[2] From the Thompson Urological Fund.

TABLE I.—INCIDENCE

Age in years	Cases	Age in years	Cases
20	1	47	1
28	1	48	1
33	1	55	1
34	2	61	1
41	1	62	1
44	2		
		Total	13

SYMPTOMS

The symptoms of this condition are not typical. In many instances a coexisting pathological condition presents symptoms and signs which predominate the clinical picture, the leucoplakia being found at the time of cystoscopic examinations in patients in whom the condition is limited to the bladder, or the condition is observed when the kidney, having been removed, is opened for study. Nevertheless, many authors mention the passage of large flakes of epithelium as pathognomonic of the presence of leucoplakia. Perhaps, it might not be amiss to present the most frequently found symptoms in this series of cases in the form of a table (Table II).

TABLE II.—SYMPTOMS

	Cases		Cases
Frequency of urination	10	Backache	1
Nocturia	7	Retention	1
Burning	7	Chills and fever	1
Hæmaturia	5	Urgency	1
Pain	5	Nausea	1
Pain on urination	4	Vomiting	1
Pyuria	4	Weakness	1
Turbid urine	2	Tingling in perineum	1
Difficulty	2	Failure of completion of ejaculation	1
Incontinence	2		
Loss of weight	2		

BACTERIOLOGY

Whether or not infection plays a rôle in the production of leucoplakia is open to question. Here, as in the rôle played by symptoms, the question of infection is often secondary, or subservient to, the underlying primary condition. In our series the histories show that in 2 cases the urine was sterile and free of infection, whereas in 8 cases infection of one sort or another was present. In 3 cases the cultures were not stated. In the 2 patients with tuberculosis of the kidney and bladder, both showed the presence of tubercle bacilli on smear and guinea-pig inoculations.

One of the interesting phases of the subject is the fact that the bacteriological studies of the urine failed to show the presence of any one organism in all of the cases, although bacillus coli either alone or in combination was the most frequent invader. This lack of constancy is also evident in the literature. Furthermore, in some cases the urines were sterile, notably in the cases of Cumming and Corsdress. Hinman, Kutzman, and Gibson found the bacillus proteus. Wilhelmi found staphylococci; Hennessey, bacillus coli and staphylococci; and Valentine, streptococci and gram-negative bacilli. Tables III and IV show the bacteriological results in our series.

TABLE III.—BACTERIOLOGY

Organism	Cases
Bacillus coli	4
Bacillus coli and hæmolytic streptococci	1
Bacillus coli and staphylococci	2
Bacillus coli and streptococci	1
Sterile	2
Not stated	3
Total	13

TABLE IV.—URINALYSIS

	Cases
Albumin	11
Pus	11
Bacteria	7
Blood	7
Epithelial cells	5

PREVIOUS VENEREAL HISTORY

For a time it was suggested that perhaps syphilis was a factor in the production of leucoplakia. Among the champions of this viewpoint may be mentioned Psodas, who believed that leucoplakia in most instances offered a pathology the origin of which could be traced back to syphilis, because specific treatment had proved effective. In our present series, a Wassermann test was made in 9 cases and was positive in 1 case. Nevertheless, the present opinion, I believe, is rather against the possibility of syphilis as an etiological factor. Gonorrhœa, too, has been held responsible, but in my opinion it can be excluded. The majority of patients in this series denied ever having had gonorrhœa, and on examination no evidence of that disease was found.

ASSOCIATED LESIONS

Various authors have from time to time included in their reports the detailed study of

coexisting lesions. There was a time when it was believed by some that leucoplakia occurred only when associated with stone and hence was due to the presence of stone, either directly or indirectly. This viewpoint we now know to be erroneous because leucoplakia may occur in many instances as an independent disease. A review of this series of cases gave the results shown in Table V.

TABLE V.—ASSOCIATED PATHOLOGY

Urethra:
1. Traumatic stricture
2. Urethral calculi with rupture of the urethra
3. No associated pathology

Bladder:
1. Stone with chronic cystitis
2. Carcinoma with chronic cystitis
3. Ulcerative cystitis with pyelonephritis
4. Tuberculosis of the bladder secondary to renal tuberculosis
5. Chronic cystitis with median bar obstruction (bifid kidney pelvis, left)
6. No associated pathology (double kidney and double ureter)
7. No associated pathology

Kidney:
1. Renal calculi
2. Renal tuberculosis
3. Hydronephrosis (infected)

CASE 1. D. G., male, aged 44 years. The patient's previous history was negative; he had had the usual diseases of childhood and denied venereal disease. The family history was negative. On April 21, 1921, while at work on a crane at a cinder pit, the patient fell on a steel rail in the pit, striking upon the perineum. There was bleeding from the external urethral orifice and in less than 12 hours, complete retention of urine. The next morning, he was taken to a hospital and the bladder was drained per catheter for 2 days. A few days later an abscess formed in the scrotum and was opened and drained. A second abscess, which opened spontaneously, developed in the scrotum after the first one healed. Until the abscesses were healed the urine was passed through the incision. The patient remained in the hospital 5 weeks.

After the patient left the hospital he noticed that he did not empty the bladder and was obliged to exert pressure on the perineum with his hands after the act of urination was apparently completed. The same was true of ejaculation; the semen was not ejected at the time of ejaculation but had to be forced out by pressure on the perineum. The sexual act was otherwise normal. Since the accident he had had some tingling in the perineum which was present only during urination. Urgency was also present occasionally. There were no other urinary symptoms present.

General physical examination was negative. There was a small scar at the penoscrotal junction, the site of the incision for draining the abscess. Some thickness and hardness at the penoscrotal junction was felt. A varicocele was present on the right side. Rectal examination was negative. Blood pressure was 122–80. Roentgen-ray examination showed a healed fracture of the pelvis. Urinalysis gave the following results: color, clear; reaction, acid; albumin, none; no blood, sugar, casts, or red blood cells; pus cell, rare. Cystoscopic examination was negative. Urethroscopic examination (Fig. 1, frontispiece) showed in the bulbous urethra a white, dry, lusterless area about the size of a bean. The surface was wrinkled, almost scaly. The edges were sharply defined and stood out in marked contrast to the normal mucosa. The posterior urethra was negative. Exploration of the urethra with a No. 27 diagnostic sound showed a very firm band at the penoscrotal juncture.

Diagnosis: traumatic stricture of the urethra; leucoplakia of the urethra.

CASE 2. J. W. K., male, aged 55 years, had had mumps and scarlet fever in childhood, rheumatism at 43, influenza at 50, urethritis complicated with bilateral epididymitis many years ago. The family history was negative. The patient stated that for the past 2 years he had noticed a lump under the urethra which had been gradually growing larger and had always been hard and firm. Four days before coming under observation, the swelling evidently ruptured into the urethra as blood was passed. Nevertheless, the size of the swelling had remained about the same.

During the past year there had been a good deal of difficulty in urination, which had become more noticeable with the increase in the size of the lump, but there had never been complete retention. No catheter had ever been used. The patient urinated every 2 or 3 hours during the day, and 3 or 4 times at night. A week prior to admission to the hospital, the patient developed chills and fever which had been present daily since then. He was obliged, because of apparent obstruction of urine, to strain a good deal, the force of the stream being practically nil and the urine merely dribbling away. Sexual symptoms were absent.

The patient had had a cataract of the left eye. The teeth were in poor condition and the pharynx was injected. Several glands of the neck were enlarged. The lungs were negative. The heart showed a mitral murmur transmitted in the axilla. Examination of the abdomen was negative. Small inguinal glands were present on the left side. On the right side was a scar, the result of an operation for hernia. The external urethral orifice was negative. A hard mass was felt at the root of the penis and extended back along the urethra almost to the front of the rectum. The perineum was swollen and sensitive and had the appearance of being œdematous. An attempt was made to pass a urethral sound, but an obstruction was met and had a gritty feeling as though the tumor mass were due to stone. Rectal examination was negative. Roentgen-ray examina-

tion showed stones in the urethra. Examination of the blood showed red blood cells, 4,736,000; leucocytes, 18,000; hæmoglobin, 95 per cent. Wassermann test was negative. Gonococcus fixation test was positive (4+). Urinalysis showed: color, turbid; odor, foul; albumin 3+; sugar, none; sediment, pus and red blood cells.

Diagnosis: multiple urethral calculi with urinary extravasation.

Operation was performed under gas anæsthesia on April 15, 1921. An incision was made in the median line over the tumor and carried back on the perineum. A large amount of pus and urine escaped. The bulbous urethra was opened for 2 inches and a large stone and several smaller ones were removed. When the urethra was opened, several areas were seen that were in direct contact with the stones and were white and dry and had the typical appearance of leucoplakia. These patches were excised for histological study and the diagnosis of leucoplakia was verified. The wound was closed in the usual manner and drains were inserted. The immediate postoperative convalescence was rather trying due to infection following the urinary extravasation. The wound was irrigated daily. Culture of pus from the wound showed colon bacilli and staphylococci.

On June 18, the wound was closed and the patient was given permission to leave the hospital. During the night he suddenly developed dyspnœa, profuse perspiration, bloody sputum, a sense of weight over the sternum, and a very productive cough. The patient died on June 19, of pulmonary embolism. Permission for an autopsy could not be obtained.

Diagnosis: urethral calculi; rupture of the urethra; leucoplakia of the urethra; pulmonary embolism.

Case 3. Miss B. M., 28 years of age, referred by Dr. W. E. Post, was admitted to the Presbyterian Hospital on May 21, 1923. She had had the usual diseases of childhood. Her appendix had been removed 9 years prior to admission to the hospital. The patient complained of pain in the lower quadrant of the abdomen which had been present for 9 years. Pain in the bladder region, for 2 months, had been severe, sharp, and marked at urination.

The patient was a sallow, undernourished woman of a very nervous type. Her pupils reacted to light and accommodation. The sclera were pale. Examination of the ears, nose, throat, heart and lungs was negative. The abdomen showed some tenderness in the right lower quadrant over the colon. Knee jerks were extremely brisk. Pelvic examination showed the uterus in second degree retroversion and not easily lifted. When the lips of the urethra were everted, two white, dry, dull patches of leucoplakia could be seen. One of these patches was located on the floor of the urethra and one on the lateral wall. Cystoscopic examination on May 23 was negative. The ureters were catheterized without difficulty or obstruction. Examination of the urine from the bladder showed bacillus coli; that from the kidney, staphylococci. Urine from the left kidney was sterile. The roentgen-ray examination was negative for stone. Pyelograms were negative. Blood examination showed: red blood cells, 5,100,000; leucocytes, 6,200; hæmoglobin, 66 per cent. Blood pressure was 90–50. The Wassermann test was negative. Many specimens of bladder urine were examined and were negative for tubercle bacilli. Examination of catheterized specimens on June 2 showed: from the bladder, 21 leucocytes per cubic millimeter; cultures showed bacillus coli but no tubercle bacilli. Urine from the right kidney showed: 3 leucocytes per cubic millimeter; cultures showed bacillus coli but no tubercle bacilli. Urine from the left kidney showed 2 leucocytes per cubic millimeter; cultures were sterile; no tubercle bacilli were found.

Guinea-pig tests on May 24, 1923, showed for the bladder specimen, a negative result for tubercle bacilli; on July 26, 1923 and June 8, 1924, the urine from the bladder and right and left kidney were negative for tubercle bacilli.

Diagnosis: retroversion of the uterus; malnutrition; hydrosalpinx; leucoplakia of the urethra.

Case 4. J. C., male, aged 47 years, was seen through the courtesy of Dr. Perry Bromberg, of Nashville, Tennessee. The patient was admitted to the St. Thomas Hospital at Nashville, on December 10, 1922. The family history was negative. The patient's previous history was negative except for an attack of epididymitis 8 years prior to his admission to the St. Thomas Hospital. For the past 10 years, it had been difficult for the patient to urinate. He stated that the stream was very easy to start and at first flowed freely, but when the act was about half finished, the flow gradually slowed down to a dribble and finally stopped. He was forced to wait a few seconds and then after relaxing, was able to finish. Straining seemed to aggravate the condition, and at times blood-tinged urine was passed. When the stream began to slow down, he suffered from a burning pain over the symphysis which radiated toward the rectum. Frequency of urination had been present for many years, and at the time the patient presented himself for examination he urinated every hour during the night and 10 or 12 times during the day.

Physical examination disclosed the following: Head and neck were negative except for the very poor condition of the teeth. Heart and lungs were negative. Examination of the abdomen showed some tenderness over the symphysis pubis extending upward about midway to the umbilicus and outward to the outer border of the rectus muscles. The external genitalia were negative except for the right testicle which was atrophic. The reflexes were normal. Examination of the urine showed: specific gravity, 1006; alkaline reaction; a trace of albumin; no sugar or casts but an occasional red blood cell. Phenolnephthalein test showed a total output of 10 per cent for 2 hours. The blood count showed 13,000 leucocytes. Blood chemistry showed: urea, 39; urea nitrogen, 18.2; non-protein nitrogen, 25. X-ray examination showed a very large stone in the bladder.

Operation was performed by H. L. Kretschmer, at the St. Thomas Hospital, Nashville, Tennessee, December 12, 1922 (courtesy of Dr. Bromberg). Through a suprapubic cystotomy, a very large stone, measuring 7.5 by 6 by 4.5 centimeters and weighing 6 ounces, was removed. At the time the bladder was opened, multiple areas of leucoplakia were found. These were removed surgically, and sections were examined by Dr. B. T. Terry of Nashville who verified the diagnosis of leucoplakia.

Diagnosis: stone in the bladder; leucoplakia of the bladder.

CASE 5. R. K., male, aged 62 years, referred by Dr. R. B. Oleson, was admitted to the Presbyterian Hospital, Chicago, on March 24, 1927. The patient's father died at the age of 72 years of carcinoma of the stomach. His mother died at the age of 49 years of carcinoma of the lungs. The patient had had gonorrhœa at the age of 20 years, but this had cleared up without complications. Syphilis was denied. The patient stated that he had always had more or less bladder trouble. He had had frequency of urination with burning and nocturia for 20 years. These symptoms had recently become aggravated so that 1½ years before coming under observation, he noticed that his urine had become turbid and contained a large amount of sediment. He also noticed at that time some discharge at the end of urination. Frequency of urination had gradually increased so that he was obliged to urinate about every 40 minutes during the day and about 10 or 15 times during the night. Hæmaturia began about 1½ years before he came under observation. It was most marked at the end of urination. He had had some deep X-ray treatment which he believed increased the pain, frequency, and hæmaturia.

Physical examination showed: head, neck, heart, and lungs, negative. The liver could be felt 2 fingersbreadth under the costal arch. The external genitalia were negative. Rectal examination showed a normal prostate. The base of the bladder felt as though it were greatly thickened. Blood chemistry: urea, 11.3; uric acid, 5; creatinin, 1.55. Blood Wassermann test gave negative results. Urinalysis showed: reaction, alkaline; albumin 4+; no sugar; blood, 2+; pus, 4+; sediment, red blood cells and motile bacilli. A catheterized specimen of bladder urine showed 240 leucocytes per cubic millimeter; cultures, staphylococcus albus and bacillus coli. Roentgen-ray examination was negative for stones in the genito-urinary tract. Cystoscopic examination under sacral anæsthesia, March 25, showed a large white necrotic tumor mass about the size of an apple, extending around the neck as well as around the base of the bladder. A great deal of redness of the vesical mucous membrane and some œdema were present. A diagnosis of carcinoma of the bladder was made.

Operation was advised and on April 12 we did a suprapubic cystotomy and applied surgical diathermy to the tumor mass. The bladder was opened and a very large, flat necrotic tumor was seen which extended from the upper part of the bladder down to the urethral orifice to the left side as far over as the base of the bladder. A very large area of leucoplakia was seen on the right side of the bladder base and wall. A small section of the tumor mass was removed for histological study, and the tumor was treated extensively with surgical diathermy. A section was removed from the area of leucoplakia for histological study, and the area was given a very thorough diathermy treatment. Convalescence was uneventful.

Diagnosis: bladder carcinoma; leucoplakia of the bladder.

CASE 6. Mrs. T. McD., widow, aged 44 years, referred by Dr. E. Spiegelberg, was admitted to the Presbyterian Hospital, December 23, 1925. She had had measles, mumps, and scarlet fever during childhood. One sister died of carcinoma of the uterus at the age of 44 years.

About 2 weeks before entering the hospital, the patient was suddenly seized with severe pain in the right upper quadrant. This was described as sharp in character. It remained localized and did not radiate. The attack lasted for 8 hours. The second attack of pain radiated from under the right costal margin to the back. A doctor was called who gave morphine to relieve the pain. She had been troubled with nocturia for about 20 years. At first the nocturia was infrequent, but at the time of admission, she was obliged to urinate 3 or 4 times every night. Frequency during the day had begun 3 years previously and had gradually increased. At the time of examination, the patient was obliged to urinate every 2 hours. The pain in the bladder was described as an aching pain. It had bothered her for many years but was always relieved by urination. A certain amount of urgency of urination was associated with this pain.

Physical examination showed that the pupils reacted to light and accommodation. The teeth had many crowns. Examination of the tonsils, neck, heart, and lungs was negative. Examination of the abdomen showed some rigidity and a palpable mass in the right upper quadrant, which was tender; there was some rigidity on the right side posteriorly. The reflexes were normal. Examination of the blood showed: red blood cells, 5,420,000; leucocytes, 19,300; hæmoglobin, 90 per cent. Blood pressure was 104–62. Roentgen-ray examination was negative for stones. Cystoscopic examination on December 26 (under sacral anæsthesia because of extreme irritability of the bladder) revealed flakes of pus adhering to the bladder mucous membrane. The ureters were normal. Cystoscopic examination (sacral anæsthesia, January 4, 1926) showed considerable redness of the trigone, flakes of pus sticking to the trigone, the right ureteral orifice gaping, the mucous membrane in the region of the left ureter velvety. Both ureters were catheterized without difficulty or obstruction. The urine from the right side was turbid with large flakes of pus. The urine from the left side was slightly turbid with specks. Urinalysis (ad-

mission specimen) showed: alkaline reaction; some albumin; no sugar; no blood; some leucocytes; some bile; many epithelial cells; a few leucocytes; and many crystals.

Examination of catheterized specimens of urine showed: from the bladder, 520 leucocytes per cubic millimeter; no casts; cultures showed bacillus coli. Urine from the right kidney showed 650 leucocytes per cubic millimeter; no casts; cultures showed bacillus coli. Urine from the left kidney showed 540 leucocytes per cubic millimeter; no casts; cultures were sterile. Repeated examinations of the urine were negative for tubercle bacilli. Guinea-pig inoculations: December 24, 1925, from bladder urine and right kidney; December 26, 1925, from bladder; December 31, 1925, from bladder; and January 4, 1926, from bladder and right and left kidney, were negative for tubercle bacilli. Pyelograms showed normal kidneys.

The patient left the hospital on January 6, 1926, and returned on January 25. She complained at this time of pain in the right side, frequency of urination, pain on urination, feeling of fullness after eating, vomiting, jaundice, and pain in the epigastrium. These symptoms began shortly after she left the hospital.

Physical examination showed that the patient's skin and the sclera of the eyes were of a yellowish tint. The mass in the right upper quadrant was much larger and more easily palpable. Blood examination on January 25 showed: red cells, 3,500,000; leucocytes, 25,000; hæmoglobin, 80 per cent; blood Wassermann, positive. The patient was seen by Dr. Ralph C. Brown and Dr. D. B. Phemister.

Diagnosis: Carcinoma of the stomach with metastasis in the liver.

Exploratory operation was done, February 8, by Dr. Phemister and a carcinoma of the stomach with nodules in the liver and obstruction to the bile ducts were found. The patient died on February 27.

Anatomical diagnosis: adenocarcinoma of the gall bladder with extensive metastases to the liver; ascending cysto-ureteropyelonephritis; leucoplakia of the urinary bladder; bilateral hydro-ureter and hydronephrosis. The lining of the urinary bladder was a dark gray-brown. About the trigone and extending up into the fundus along the lateral walls there were flat, irregular, slightly elevated, whitish, palpable plaques 1 to 3 or 4 millimeters in diameter. Several of these small white plaques were removed for histological study.

Histological diagnosis: leucoplakia of the urinary bladder; adenocarcinoma of the gall bladder with metastases to the liver.

CASE 7. T. M., male, aged 20, single, referred by Dr. Dean Lewis, was admitted to the Presbyterian Hospital, July 3, 1923. The patient stated that he had had more or less urinary distress for 3 years consisting of frequency, burning, and pain on urination; also nocturia. Frequency was more marked at night than it was during the day. It gradually increased until he was obliged to void about every 2 hours during the day and night. Hæmaturia began about 2 years ago, and blood had been present in the urine from time to time. The patient thought that pus had been present in the urine practically all of the time.

The patient was a well developed and well nourished male. The examination of the head, neck, heart, lungs, abdomen, external genitalia, and extremities was negative. Several examinations for spinal cord lesions disclosed negative findings. Rectal examination showed a small prostate and the margins of the left lobe were hard—questionable for tuberculosis. Blood examination: leucocytes, 12,400; hæmoglobin, 90 per cent. Blood chemistry: blood sugar, 150; urea, 65; uric acid, 5.6; creatinin, 3.2; non-protein nitrogen, 60. Urinalysis showed: reaction, alkaline; albumin, 4+; some blood: no sugar; no casts; sediment, leucocytes, epithelial cells, phosphates. The residual urine amounts varied from 100 to 360 cubic centimeters.

Cystoscopic examination, July 17, 1923, revealed a large white area of leucoplakia around the internal urethral orifice, beginning above and extending to the right side about half way down to the base. Examination of a catheterized specimen of urine, July 17, showed from the bladder, 840 leucocytes per cubic millimeter. Cultures were sterile, no casts were found, and the urine was negative for tubercle bacilli. Repeated examinations of bladder urines were negative for tubercle bacilli. Guinea-pig inoculations on July 25 and 27, from the bladder, were positive for tubercle bacilli. Examination of catheterized specimens from the bladder on August 28 was positive for tubercle bacilli.

Diagnosis: leucoplakia of the bladder; renal tuberculosis.

The patient died in March, 1924, of uræmia. Unfortunately, an autopsy could not be obtained.

CASE 8. I. M. B., male, aged 34 years, was admitted to the Presbyterian Hospital, November 27, 1927. Five years previously, the patient had had a gonorrhœal infection, complicated with gonorrhœal rheumatism. The present illness began July, 1927, when the patient acquired a gonorrhœal infection. Several weeks subsequently epididymitis developed, at which time he suffered from burning on urination, great frequency of urination, and nocturia. Pus was present in the urine, and there was almost constant dribbling. The burning was most marked along the urethra. The acute symptoms soon subsided and irrigation and massage of the prostate were instituted. In November, hæmaturia developed and large clots were passed. The urine was decidedly turbid and had a foul odor.

Physical examination showed: the head and neck, negative; the tonsils, moderately enlarged; the lymph glands in the neck, palpable; the thyroid, negative; the heart and lungs, negative. Examination of the abdomen was negative. The external urethral orifice showed no urethral discharge. There was enlargement and some tenderness involving the right epididymis. The left cord was slightly enlarged

and tender. On rectal examination, the margins of the right lobe were easily palpable; the margins of the left lobe could not be outlined as they fused with the bony pelvis. The left seminal vesicle was exceedingly hard and broad and seemed to be in one mass with the prostate. The right seminal vesicle was soft. Strippings from the prostate showed a few gonococci.

Treatment consisted of baths, internal medication, and sedatives. The condition remained unimproved, and on account of his unfavorable state of health, the patient was sent to the hospital.

Blood chemistry, December 10, showed: urea, 10.5; uric acid, 4.1; creatinin, 1.5; non-protein nitrogen 27.8. Blood examination showed: red cells, 4,390,000; leucocytes, 13,250; hæmoglobin, 80 per cent. Blood Wassermann was negative. Blood pressure was 138–108. Examination of catheterized bladder urine December 6, showed: 79,000 leucocytes per cubic millimeter; sterile cultures; and no tubercle bacilli. Cystoscopy, under deep ethylene anæsthesia, December 7, disclosed a severe generalized cystitis, some bleeding from the neck of the bladder; the interurereteric ligament markedly hypertrophied and at the base of the bladder multiple areas of ulceration and a large median bar. Both ureters were catheterized without difficulty or obstruction. Examination of catheterized urines showed: from bladder, 27,200 leucocytes per cubic millimeter; from right kidney, 40 leucocytes per cubic millimeter; from left kidney, 10 leucocytes per cubic millimeter. Smears showed no organisms; cultures were sterile. Pyelograms showed a bifid pelvis of the left kidney, the lower end of the ureter dilated, and the right kidney normal.

After failure to obtain relief through the usual forms of treatment, a suprapubic cystotomy was performed on December 14. The bladder wall was found to be exceedingly thick. The mucous membrane over the trigone was markedly hypertrophied, thick and granular. Around the neck of the bladder was seen an area of ulceration which completely surrounded the internal urethral orifice and bled very easily. The bladder neck was exceedingly tight and a definite median bar was seen. On the posterior wall, there was an ulcer about 2½ inches long. On the posterior wall, 2 white areas of leucoplakia were found.

Diagnosis: median bar hypertrophy with contracture of the internal urethral orifice; ulcerative cystitis; leucoplakia of the bladder; and bifid kidney pelvis (left).

Case 9. Mrs. R. S., aged 53 years, referred by Dr. D. B. Phemister, was admitted to the Presbyterian Hospital, January 27, 1926. The family history was negative. The patient had been married 9 years and had never been pregnant. Eleven years before admission to the hospital, the patient had begun to have frequency of urination associated with marked urgency and some incontinence. The condition remained about the same and several years later she began to notice that some of the urine appeared cloudy. Passage of urine was accompanied with a burning sensation. For this she had been treated with bladder lavage for 2 or 3 years, and the condition had improved somewhat. The pain in the left renal area started in 1923. It radiated along the course of the left ureter, was sharp and cutting, and interfered with the patient's sleep. She was obliged to urinate every 10 or 15 minutes during the day and 4 or 5 times at night, sometimes more often than this.

Physical examination of the head, neck, heart, lungs, and abdomen was negative. Blood examination showed; leucocytes, 11,100; hæmoglobin, 88 per cent. Blood pressure was 104–70. Roentgen-ray examination was negative for stones. Urinalysis showed: acid reaction; albumin, 3+; no sugar; blood, 3+; pus, 2+. Thalein test showed an output of 55 per cent in 1½ hours. Time of appearance was 5 minutes.

Cystoscopic examination, January 28, 1926, showed a large, dull white wedge-shaped area about the size of a silver dollar, extending from in front of the air bubble above to, or nearly to, the internal urethral orifice below. The margins of the mucous membrane of the bladder were hyperæmic. A similar area was seen on the trigone in front of the right ureteral orifice. The ureters were catheterized without difficulty or obstruction. Examination of the catheterized specimens of urine showed: from the bladder, 1240 leucocytes per cubic millimeter. Cultures showed bacillus coli but no tubercle bacilli were found. Urine from the right kidney showed 5 leucocytes per cubic millimeter. Cultures showed bacillus coli and streptococcus hæmolyticus but no tubercle bacilli. Urine from the left kidney showed 5 leucocytes per cubic millimeter. Cultures showed bacillus coli but no tubercle bacilli. Guinea-pig inoculations of urine from the bladder and the right and left kidney were negative for tubercle bacilli.

Cystoscopic examination, February 2, verified the findings of the first examination. At this time, however, two ureteral openings were found on the left side, one of which had been overlooked at the first cystoscopic examination. The two left ureters were catheterized with the following results: from the lower left kidney, no leucocytes; sterile cultures; no tubercle bacilli; from the upper left kidney, 1 leucocyte per cubic millimeter, sterile culture, no tubercle bacilli. Guinea-pig inoculation, February 1, showed that urine from lower left kidney and upper left kidney were negative for tubercle bacilli. A pyelogram showed a double kidney pelvis and double ureters on the left side.

Diagnosis: Leucoplakia of the bladder; double kidney pelvis and double ureters (left).

Case 10. Mr. C. W., aged 48 years, referred by Dr. W. E. Post, was admitted to the Presbyterian Hospital, November 30, 1923. The previous history was negative except for a gonorrhœal infection 20 years prior to examination. One year ago, the patient consulted a physician for so-called rheuma-

tism. He was told that the rheumatism was due to an infected diverticulum of the bladder. In June, 1923, the diverticulum was removed and the rheumatism improved. After the operation, the patient was troubled with frequency of urination which gave him a good deal of distress. At times he was obliged to void every 15 minutes during the day and 3 times at night. He also noticed hæmaturia and stated that before the operation, he had never seen blood in the urine. Burning and smarting at the beginning and end of urination were associated with frequency and hæmaturia and extended from the tip of the penis to the anus. He had been unable to work much since the operation on account of weakness. He had lost about 35 pounds in weight. He also complained of rheumatic pains in the hips, knees, back, and shoulders.

Physical examination of the head and neck was negative. Pus was found in both tonsils. The heart and lungs were negative. The abdomen showed a scar above the symphysis pubis but was otherwise negative. Examination of the external genitalia was negative. Rectal examination disclosed a very large, hard, and firm prostate. Massage expressed pus, and cultures of it showed streptococci. No residual urine was found. Blood examination showed: red cells, 5,346,000; leucocytes, 6,600. Blood pressure was 100–72. The blood Wassermann test was negative. Roentgen-ray examination of the teeth showed apical abscesses. The genito-urinary examination was negative for stones. The urine was turbid. Specific gravity was 1012; reaction, alkaline; albumin, present; some blood but no sugar was present. The sediment consisted of pus and epithelial cells. Cystoscopic examination, December 7, showed two areas of leucoplakia on the anterior wall and on the left lateral wall; and a moderate amount of cystitis. Both ureters were catheterized without difficulty or obstruction. Examination of the catheterized specimen of bladder urine showed bacillus coli. Smears made from the caseous material obtained at the time of the cystoscopic examination showed no tubercle bacilli or other organisms. Examination of the catheterized specimens of urine from the bladder showed: 510 leucocytes per cubic millimeter; none from the right kidney; and 40 from the left kidney. Cultures made from the urine of the bladder and left kidney showed streptococci. Urine from the right kidney was sterile. Repeated examinations of the urine were negative for tubercle bacilli. Guinea-pig inoculations, January 19, 1924, were negative for tubercle bacilli from the bladder and both kidneys. Pyelograms showed normal kidneys. Two subsequent cystoscopic examinations yielded essentially the same findings as did the first examination. With a cystoscopic rongeur, a piece of tissue was removed for histological study, and this showed the presence of leucoplakia.

A diagnosis of leucoplakia was made with the urethroscope and was verified by the histological examination of sections.

CASE 11. I. O'B., female, aged 34 years, married, was admitted to the Presbyterian Hospital, April 14, 1926. She had two children living and well. She had had the usual diseases of childhood. Her father died of cardiorenal disease at the age of 74 years; her mother died of a paralytic stroke at the age of 53 years; otherwise the family history was negative. The present illness began a year ago when the patient noticed burning on urination just before the act was finished. The burning increased in severity so that at the time of examination it was continuous. For this she had had some treatment which failed to give relief. Frequency of urination began with the burning. At times she urinated every 30 minutes, at easier periods every 2 to 4 hours. She had had to urinate at night for the past 2 years: the first year, once or twice during the night; the second year, 3 or 4 times a night. Urgency had been present for a year, and when desire came she had to respond immediately. About 10 months ago, she noticed blood at the end of each urination. The urine was dark, therefore the blood must have been fresh. No such manifestation had been seen since.

Physical examination showed a very pale, undernourished woman. Tonsils had been removed but part of the right one remained. The mucosa of the mouth was pale and the gums bled easily. The head, neck, heart, and lungs examination was negative. Some rigidity and tenderness were found in the right upper quadrant. The left kidney and spleen were not palpable. A rigid mass could be felt in the right flank. Rectal examination was negative. Vaginal examination showed an enlarged uterus in third degree retroversion. Blood examination showed: red cells, 4,150,000; leucocytes, 14,500; hæmoglobin, 73 per cent. Blood pressure was 102–78. Blood chemistry: urea, 13.66; uric acid, 2.42; creatinin, 1.20; non-protein nitrogen, 33.32. Urinalysis: acid reaction; albumin, 2+; no sugar; blood, 2+; pus, 4+; no casts; sediment, a few red blood cells and motile bacilli.

Examination of catheterized bladder urine showed: 16,121 leucocytes per cubic millimeter; bacillus coli but no tubercle bacilli. Thalein test showed the time of appearance to be 5 minutes; the first 30 minutes, 35 per cent; second 30 minutes, 20 per cent; third 30 minutes, 5 per cent; 1½ hours, 60 per cent. Roentgen-ray examination of the chest was negative. Cystoscopic examination, April 14, showed: bladder capacity limited; right ureteral orifice, normal; left ureteral orifice, retracted. To the right of the left ureteral orifice appeared an area of ulceration. The right side was catheterized, but it was impossible to catheterize the left side. Examination of catheterized specimens of urine showed: from the bladder, 8,000 leucocytes per cubic millimeter; from the right kidney, 2 leucocytes per cubic millimeter; no casts; no organisms on gram smear; sterile cultures; no tubercle bacilli. Tubercle bacilli were found in the examination of centrifuged bladder urine on April 15. Guinea-pig inoculation, April 14, from the bladder, was positive for tubercle

bacilli; from the right kidney, negative for tubercle bacilli. Guinea-pig inoculation, April 26, of urine from bladder was positive for tubercle bacilli, from right kidney, negative.

Operation, April 29, left nephrectomy. The kidney showed two large abscessed cavities filled with pus. These were about 3 centimeters in diameter. In the pelvis at the level of the middle calyx was an area of leucoplakia about 2 centimeters in diameter. The epithelium scaled in thin white flakes. At the junction of the lower and middle third was an area of multiple tubercle formation, extending from the pelvis clear through to the outer side of the kidney. The ureter was dilated and thickened. The ureteral mucous membrane was studded with miliary tubercles. The abscessed cavities were rigid and thick, indicating that the cavities were old. The patient had an uneventful convalescence and was discharged from the hospital, May 11, 1926.

Diagnosis: tuberculosis of the left kidney; leucoplakia of the left kidney pelvis.

Case 12. H. S., male, aged 41 years, single. Patient was seen at the United States Veteran's Hospital No. 76, January 30, 1923. He had been operated upon some time previously for multiple calculi of the urethra. Venereal disease was denied. About 5 years before coming under observation, he began to complain of frequency of urination, burning, tenesmus, and turbid urine containing flakes. This condition remained unchanged for about 2 years. Some relief was obtained with bladder irrigations. He had passed blood in the urine which he said looked like old clots.

About 3 years before coming under observation, he began to have definite cramp-like pains in the left loin and flank, much burning, frequency, nocturia and tenesmus. Two years ago, he was unable to pass more than a few drops of urine at a time, and this condition persisted for 5 days. On examination a large calculus was found in the anterior urethra, and later two more were found in the posterior urethra and two in the bladder. These were removed surgically.

Frequency of urination had been present for 4 years. He was obliged to urinate every 1½ hours during the day and 3 times at night. He stated that the urine had been cloudy for the past 5 years and had never wholly cleared up. Pain had been present in the left loin and flank daily for 4 months, never extending below the umbilicus. It began about 3 a. m. and persisted until the patient got up.

Physical examination showed that the pupils reacted to light and accommodation. Tonsils were small. Teeth were in good repair. The examination of the neck and lungs was negative. The apex was inside of the nipple line. A slight systolic thrill was heard over the apex and accentuation of the second sound. Examination of the abdomen, external genitalia, and rectum was negative. Blood chemistry showed: urea nitrogen, 26.0; uric acid, 2.2; creatinin, 1.5. Blood pressure was 118–82. The Wassermann test was negative. Roentgen-ray examination showed a shadow in the region of the left kidney compatible with stone.

The urine was straw color; specific gravity, 1020; some albumin and some blood; no sugar; sediment, pus, 3+; red blood cells, 3+; triple phosphates. Thalein test, February 8, 1923, from the right side: time of appearance, 6 minutes; first 30 minutes, 15 per cent; second 30 minutes, 5 per cent; total, 1 hour, 20 per cent; from the left side: time of appearance, faint in 6 minutes; first 30 minutes, 5 per cent; second 30 minutes, 0; total, 1 hour, 5 per cent.

Cystoscopic examination, February 19, showed a mild generalized cystitis. The ureters were catheterized without difficulty or obstruction. Clear urine was obtained from the right ureter and thick foul urine from the left ureter. Examination of the urine obtained at the time of the cystoscopic examination showed the following: from the bladder and left kidney, many pus cells; from the right kidney, occasional pus cells. Cultures from the bladder and right kidney showed bacillus coli; from the left kidney, sterile cultures. Albumin was present in all specimens and also red blood cells, the right kidney showing 3+. All specimens were negative for tubercle bacilli. Thalein test on March 3, showed 17 per cent the first hour; 20 per cent the second hour; 37 per cent, total for 2 hours. Pyelograms of the right side showed a normal condition. The left side showed dilatation of the ureter. The kidney pelvis was normal in size but atypical in shape. The calyces were enlarged and irregular in outline.

Operation, March 27: left nephrectomy. The kidney showed much retraction and scar formation. The perinephritic fat was dense and adherent. About three-fourths inch below the lower border of the kidney, there was a stricture of the ureter, above which the pelvis was dilated. In the lower pole of the kidney was a large cavity which contained a single stone (Fig. 2, frontispiece). The pelvis and lower pole were filled with a very large stone. The mucous membrane of the pelvis was red, swollen, and œdematous, smooth and glistening, and showed many small granular spots standing out in marked contrast to the mucous membrane of the superior calyces and lower part of the pelvis. This section of the mucous membrane had a dull china-white color. It was smooth, without luster, and appeared very dull and extended to, but not into, the large cavity from which the stone was removed. Convalescence after the operation was uneventful.

Diagnosis: stricture of the ureter; hydronephrosis (infected), stone in the kidney; leucoplakia of the kidney pelvis.

Case 13. F. D. B., male, aged 61 years, referred by Dr. D. B. Phemister, was admitted to the Presbyterian Hospital, January 18, 1925. The family history was negative. Six weeks before coming to the hospital, the patient had had all of his teeth extracted on account of infection. The patient stated that his present illness began about 35 years ago, at which time he had a severe attack of

renal colic which was associated with the passage of gravel. He had passed stones many times since, and had had repeated attacks of renal colic. The last attack occurred one year ago. He was obliged to urinate about 9 times during the day and twice during the night. Frequency of urination was associated with persistent burning and some pain. He stated that thick pus had been present in the urine but he had had no bladder symptoms.

Physical examination showed a well developed and well nourished man. The examination of the head, neck, heart, and lungs was negative. The liver, spleen, and kidneys were not palpable. No tenderness was present over the kidney region nor over the bladder area. The external genitalia were negative. The reflexes were normal. Rectal examination showed a moderate hypertrophy of the prostate. Blood examination showed: red cells, 4,560,000; leucocytes, 11,000; hæmoglobin, 85 per cent. Blood pressure was 122–64. Blood chemistry: urea, 40; uric acid, 4.0; creatinin, 1.25; non-protein nitrogen, 37. The blood Wassermann test was negative.

The urine was cloudy; reaction, alkaline; some albumin; no sugar; no blood; some pus; no casts; phosphates in sediment. The thalein test showed time of appearance from left to be 7 minutes; the first 10 minutes, 3 per cent; the second 10 minutes, 8 per cent; a total of 11 per cent in 20 minutes. Roentgen-ray examination disclosed no stone. Cystoscopic examination, January 23, 1925, showed a mild generalized cystitis and a definite median-bar formation. Both sides were catheterized without difficulty or obstruction. The urine from the left side was clear; from the right side, cloudy. Right pyelogram showed a very large hydronephrosis. Examination of catheterized urines showed: from the bladder, 3,260 leucocytes per cubic millimeter; from the right kidney, 2,400; from the left kidney, 40. Cultures showed bacillus coli from the bladder and right kidney. The left kidney urine was sterile. No tubercle bacilli were found. Guinea-pig inoculations, January 23, of urine from the bladder and right and left kidneys were negative for tubercle bacilli. Cystoscopic examination, January 26, verified the previous findings. Guinea-pig inoculations, January 26, of urine from the bladder and right kidney were negative for tubercle bacilli.

Operation, February 11: nephrectomy. The kidney and ureter weighed 105 grams. The capsule stripped easily. The cortex of the kidney had an average thickness of 1.5 centimeters, and was light brown in color. The pelvis of the kidney was dilated. The calyces were broad and dilated. The epithelium lining of the pelvis was blue gray in color (Fig. 3, frontispiece); thickened 1 millimeter in patches; showed longitudinal wrinkles and folds; and the inferior calyx was entirely lined with the thickest patch. The middle and superior calyces were lined with slightly thinner patches of epithelium. The ureteropelvic junction and part of the pelvis were thinner and more orchid in color. There were patches from 3 to 7 millimeters in diameter in the pelvis. This leucoplakia extended down the ureter 13.5 centimeters.

Diagnosis: hydronephrosis (infected); leucoplakia of the kidney pelvis and ureter.

The patient made an uneventful recovery and was discharged from the hospital, February 27 1925.

SUMMARY

1. Leucoplakia of the urinary organs probably occurs more frequently than we believe.

2. Leucoplakia may occur in association with various lesions of the urinary tract, such as stone, infection, and tuberculosis, or it may be the only lesion present.

3. As various types of organisms have been found in cases of leucoplakia, it has not as yet been determined what relation if any exists between the condition and the organism found.

4. In this series, there were twice as many males as females.

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A CONSIDERATION OF CERTAIN DERANGEMENTS OF THE KNEE JOINT

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DISTURBANCES in the function of the knee joint are becoming more frequent, and accumulating experience allows us to recognize these disabilities earlier and to offer, in most cases, definite, favorable therapy. The following report of a variety of these conditions is presented in the hope that those cases which may be given beneficial therapy will no longer remain in the group of chronic, permanent disabilities to which some of them have been relegated.

The incidence of certain derangements is largely dependent upon the social environment, as for example, the industrial hazards or the type of athletics common to the community. In England where football is a more open game, displacement and laceration of the semilunar cartilage is more common than in this country. In our larger centers automobile traffic has almost transformed the streets into fields for athletic prowess. The thrust of the bumpers of cars against the legs of pedestrians is producing an increasing number of lacerations of ligaments about the knee joint which may be complicated by dislocation or fracture of the cartilages. Inadequate treatment of these acute cases results in chronic disability referable to the joint. This paper chiefly concerns the management of these acute cases.

In the minds not only of the laity, but of too great a number of physicians, there is the misconception that limitation of motion or stiffness frequently follows operations of any type upon the knee joint. Sir Arthur Keith states in his foreword to Fisher's (1) book entitled *Internal Derangements of the Knee Joint:* "The lay mind still harbors the belief that there are certain disorders of the human body, and in this number internal derangements of the knee joint must be included, which can be cured only by the application of a manipulative form of magic. There is only one form of curative magic—the application of measures founded on an accurate knowledge of structure, function, and disease."

The term "internal derangement of the knee joint" was first used by William Hey (1803) in his book *Practical Observations in Surgery*, chapter VI. Prior to Hey's consideration such disturbances of the knee joint were known to Hippocrates. When Hippocrates states: "The bones of the knee are frequently dislocated, but they are easily reduced, for no great inflammation follows," one is led to believe that he must certainly refer to the same disturbance as Hey, using the term "dislocation" instead of "internal derangement." Quoting from Fisher (1), Hippocrates also says: "The reduction in these cases is not difficult, but in the dislocations inward and outward, the patient should be placed in a low seat and the thigh should be elevated, though not much. Moderate extension for the most part is sufficient, extension being made at the leg and counter extension at the thigh."

Hey states: "the joint of the knee is so firmly supported on all sides by tendinous and ligamentous substances, that the bones of the thigh and leg are very rarely separated from each other so as to form a dislocation, in the common sense of the term, yet this joint is not infrequently affected with an internal derangement of its component parts; and that sometimes in consequence of trifling accidents, the disease is, indeed, now and then removed as suddenly as it is produced by the natural motions of the joint, without surgical assistance, but it may remain for weeks or months, and will then become a serious misfortune, as it causes a considerable degree of lameness." He further states that he is unfamiliar with any previous description of this disease or remedy and then proceeds to give the history and treatment of several cases. True dislocation of the knee is a rare condition and infrequently encountered even in our present day of industrial hazards and automobiles.

Vesalius refers to them as insignificant accidents, while Meyer, of Zurich, elucidated

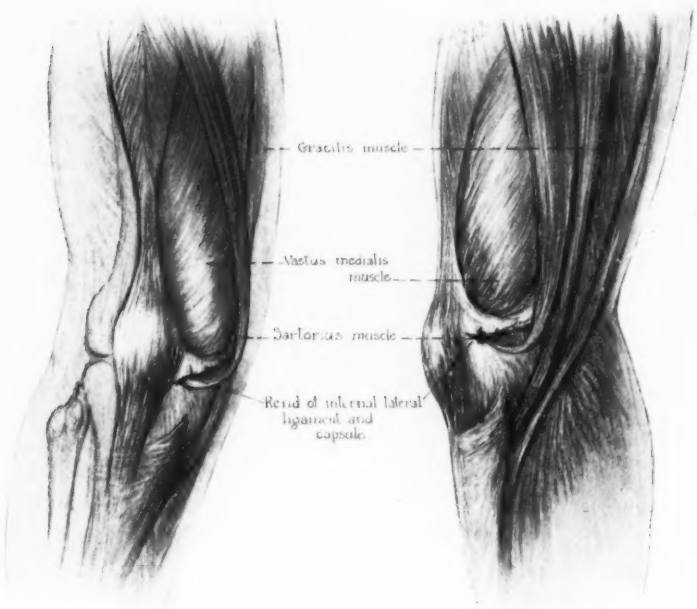

Fig. 1. Case 1. Schematic drawing illustrating the laceration of internal ligament and displacement of sartorius tendon.

clearly the anatomy and mechanism of the disturbance, emphasizing particularly the importance of the rotation of the tibia, inward and outward, around an oblique axis upon commencement of flexion and termination of extension, and also how the condyles of the femur rolled upon the curved, yielding body of the semilunar cartilages.

Thomas Annadale in 1885 was the first surgeon to operate upon a patient with disturbance of the semilunar cartilage. He sutured a torn anterior end of an internal semilunar cartilage to its original site with an excellent result. The results gained in this case suggested the possibility for relief of derangements of the knee joint by surgical methods and at the same time revealed the pathology which was responsible.

Three hundred years previously Ambroise Paré had successfully removed a loose body or "stone" from the knee, which was classified by him as a monstrosity, so that he doubtless had little conception as to the pathology of such diseases.

Alexander Monro and John Hunter have both offered theories to explain the presence of loose bodies, the former believing them to be derived from the articular ends of the bones while the latter felt they resulted from unabsorbed extravasations of blood into the joint following injury. Sir James Paget suggested the theory of "quiet necrosis," i.e., these bodies are sequestra exfoliated after necrosis of injured cartilage with *acute inflammation*.

There is little evidence to support the theories of Monro and Hunter. Koelliker discovered cartilage cells in the synovial villi and E. Rainey evolved the theory of loose bodies produced from this tissue. Surls and Osgood (6) report that "Monro, Hunter, and Koelliker between them traced out the three main sources of loose bodies." Koenig considered the majority were detached by a dissecting osteochondritis.

Fig. 2. Case 3. Internal semilunar fibrocartilage of the left knee which illustrates the displacement of the posterior cornua with the formation of a bulbous tip.

William Hey also considered the surgical removal of loose cartilaginous substances from the knee joint. He says: "although it has often been attended with success, yet as the late Medical Society has observed, it has sometimes been followed with violent inflammation, fever, and death itself. It would, therefore, be of service to mankind could a method be invented of curing this disorder with safety, or rendering it of no inconvenience to the patient."

The expressed desire of Hey has been completely realized in our present day surgery. This *bête noire* was a justifiable one during the pre-antiseptic era, but not so today.

The hazard of joint sepsis retarded the development of surgery of the knee joint for many years, until we find Herbert Allingham (1889) insisted to the profession that, with careful antiseptic technique, operations on the knee joint are as safe as procedures upon the peritoneal cavity.

CASE 1. No. 110764. *Complete laceration of the internal lateral ligament and posterior capsule of the right knee joint; lateral mobility of 30 degrees; surgical repair 48 hours post-traumatic with return of normal function.*

A male steel worker, 28 years of age, was admitted to the Lakeside Hospital December 19, 1925, with the complaint of pain in the right knee. Thirty minutes before admission to the Accident Ward his right lower thigh was struck by the bumper of an automobile. The blow threw him to the pavement. Upon an attempt to use the right leg, the pain in the knee was so severe that he could not walk. The past history was essentially unimportant.

The physical examination revealed a well developed adult male. The heart, lungs, and abdomen were normal. There were minor lacerations over the face. A small abrasion in the neighborhood of the lateral side of the right knee was noted. There was slight swelling of the part and a small area of ecchymosis along the medial aspect just beneath the condyle of the tibia. Palpation revealed an area of tenderness on the medial side in the neighborhood of the tuberosity of the tibia. The patella was not ballottable, and passive flexion and extension at the knee could be carried out with only slight pain. Lateral mobility of 30 degrees was present. In the extreme position it caused considerable pain, and with the knee flexed to 90 degrees, the tibia could be displaced forward to a moderate degree without any backward displacement. A roentgenogram of the right knee showed no evidence of fracture.

The urine upon six examinations was normal. The leucocytes ranged between 9,200 and 11,800. The blood Wassermann was negative.

In view of the findings of the abnormal lateral range of mobility at the knee joint, a suture of the part was indicated. The part was cleansed with soap, water and alcohol, and a sterile dressing applied 24 hours before operation. Under gas oxygen ether anæsthesia, the skin over the right knee was cleansed in the usual manner with alcohol and bichloride, and a linear incision 6 inches in length was made over the internal aspect of the knee. It was carried down to the fascial insertion of the sartorius which showed a complete transverse tear in the fascial and the internal lateral ligament, together with a portion of the posterior capsule (Fig. 1). The tear extended into the knee joint, involving about 1 centimeter of the lateral synovial membrane. The attachment of the sartorius muscle was completely avulsed and the distal portion was folded back between the condyle

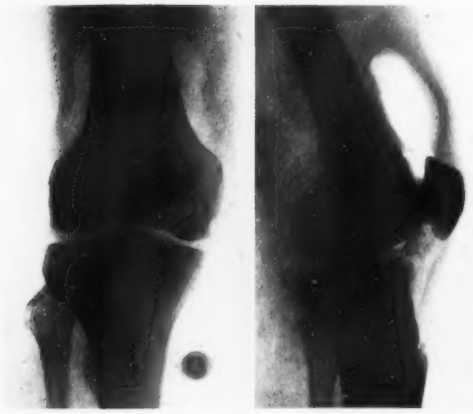

Fig. 3 (left). Case 5. Arthropneumogram of right knee which shows a punched out area upon the medial condyle of the femur representing the probable origin of the loose body which cannot be visualized in the film. The exostosis upon the lateral aspect of the tibia is of no consequence.

Fig. 4. Case 5. Arthropneumogram of the right knee in the lateral position; the joint space is clearly outlined.

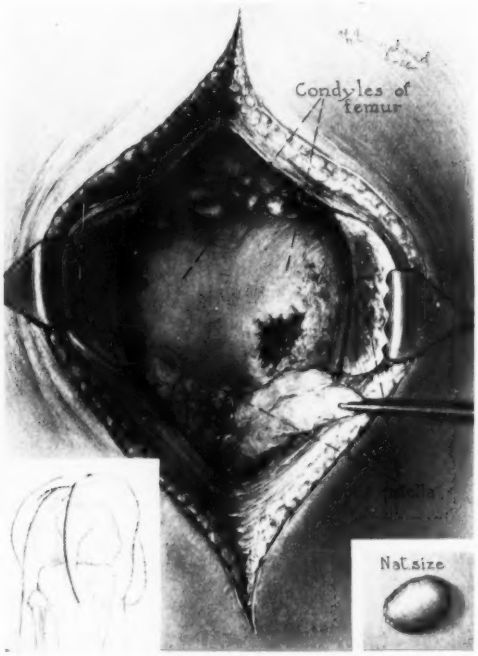

Fig. 5. Case 5. Sagittal incision of knee joint showing the erosion of the condyle from which the loose body probably arose; also, the hypertrophied synovial membrane and infrapatellar fat pad.

of the femur and the tuberosity of the tibia. A moderate sized hæmatoma was wiped away. The internal lateral ligament was sutured with mattress sutures of No. 3 chromic catgut. The semilunar cartilage was sutured to the ligament with No. 1 chromic sutures. The fascia of the sartorius was sutured to its former site and the skin closed with interrupted silk. The leg was encased in a plaster cylinder in 30 degrees flexion. The patient made a normal postoperative convalescence. The maximum rise of temperature was 38.5 degrees which occurred one week after operation, the result of a pharyngitis. Two weeks after the operation baking and massage were begun, and active motion was started at the expiration of 3 weeks.

The patient was discharged from the hospital January 6, 1926, upon crutches, wearing a Thomas knee cage splint, and he was seen at intervals in the dispensary. The cage splint was removed at the end of 3 months, and examination at this time showed the range of mobility in the right knee to equal that of the left. He experienced no difficulty in walking and then returned to work at the end of 4 months. There was no difference in the lateral mobility of the right as contrasted with the left knee.

Case 2. No. 119595. *Complete laceration of the internal lateral ligament, right knee; surgical repair and removal of internal semilunar cartilage with return of complete function.*

A white male, 38 years of age, a molder by occupation, while intoxicated, was struck upon the right lower lateral thigh by the bumper of an automobile. He was brought immediately to the hospital on July 4, 1927. Because of his mental state little definite information could be gained relative to the manner in which he had been injured. His past history was essentially unimportant.

The physical examination showed multiple contusions over the left temporal and supra-orbital regions; there was moderate congestion of the conjunctiva of the left eye. The heart, lungs, and abdomen were normal. There were two abrasions in the neighborhood of the right patella with slight swelling of the knee joint itself. The suprapatellar pouch bulged slightly, and there was considerable tenderness to pressure over the internal joint space and the region of the insertion of the sartorius. Flexion and extension of the knee was complete. There was an abnormal range of 30 degrees adduction with no anterior or posterior displacement of the tibial tuberosities. The white blood count was 11,000, hæmoglobin 90. The urine was normal except for a few white blood cells. The blood pressure was 120—80.

The roentgenogram of the knee failed to show any evidence of fracture. A complete tear of the internal lateral ligament and the insertion of the sartorius seemed to have occurred. Consequently, at the end of 48 hours under gas oxygen anæsthesia a linear incision 5 inches in length was made over the mid-internal aspect of the right knee joint; there was a

small hæmatoma present; the attachment of the sartorius was torn, the upper portion rested about one inch above its insertion. A complete transverse tear of the internal lateral ligament was present and the attachment of the lateral portion of the internal semilunar cartilage was severely lacerated. The cartilage was excised and the internal lateral ligament was approximated and sutured with No. 2 mattress chromic catgut. The sartorius was sutured with interrupted No. 1 chromic catgut. The leg was encased in a plaster cylinder from toes to groin with 15 degrees flexion at the knee.

The patient made a normal postoperative convalescence; the maximum rise of temperature occurred on the first day after admission, reaching 30 degrees C. On the third day after operation, it reached the same point and descended to normal within 10 days. The wound healed *per primam;* a moderate amount of serum accumulated in the joint and was aspirated at 10 days and 2 weeks after the operation.

Physiotherapy, consisting of baking and massage, was begun 10 days after operation, and active motion in the knee was started at the end of 2 weeks. Three weeks after operation the patient was allowed to walk with the use of crutches and he was discharged from the hospital August 30, 1927. Complete weight bearing was allowed at the end of 6 weeks after the operation. At the expiration of 2 months, examination of the knee showed 120 degrees of motion. There was moderate thickening of the periarticular portion of the internal aspect at the right knee with about 5 degrees increase in lateral mobility of the right leg as contrasted with the left; extension was complete and flexion was limited 30 degrees. Three months after operation motion was normal, the knee stable, and the patient had returned to his former work.

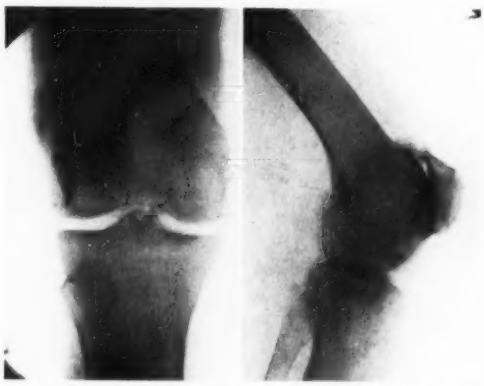

Fig. 6 (left). Case 6. Roentgenogram of the right knee joint which illustrates typical arthritic changes together with irregular dense shadows of the loose bodies in the suprapatellar pouch.

Fig. 7. Case 6. Roentgenogram of the right knee joint showing a large hypertrophic spur upon the superior margin of the patella and the shadows of loose bodies in the suprapatellar pouch.

The first case mentioned was among the early ones when the fear of an insufficiently long period of fixation dominated our behavior. However, as more of these cases were treated by surgical restitution, we began to change our point of view, feeling that soft tissues around the knee joint, when properly handled, should heal as rapidly as elsewhere.

It has been the custom to apply a plaster cylinder from the toes to the groin with the knee flexed 15 degrees for a period of 10 days, then a Cabot posterior wire splint for another 10 days. Physiotherapy has been commenced 10 days after operation and active motion without weight bearing 2 weeks after operation under the guidance of a trained physiotherapist. The splint has been discarded at the end of 3 weeks; walking with the aid of crutches has been begun at this time, gradually increasing weight bearing until 6 weeks when walking without crutches or apparatus has been allowed. This régime represents a much earlier return to work than our former one of more prolonged fixation and convalescent splinting with a Jones cage knee splint, all of which produced an extreme degree of muscle atrophy and to a tremendous degree defeated our aim of a stable weight bearing member. This very important factor is so frequently lost sight of that one cannot refrain from emphasizing it.

The second case is a more recent one and demonstrates an earlier return of function with much less economic loss to the patient and to his employer.

These cases are excellent examples of what can happen following an acute sudden thrust against the lower thigh when the fulcrum is quite close to the knee joint. Although other cases similar in character with the same result might be cited, these were considered typical. The pathology demonstrated at operation impresses one with the great importance of immediate apposition of the damaged structures. It is unfortunate that surgical textbooks, in particular orthopedic ones, either fail to mention the treatment of this disturbance or suggest that "a splint be worn for a

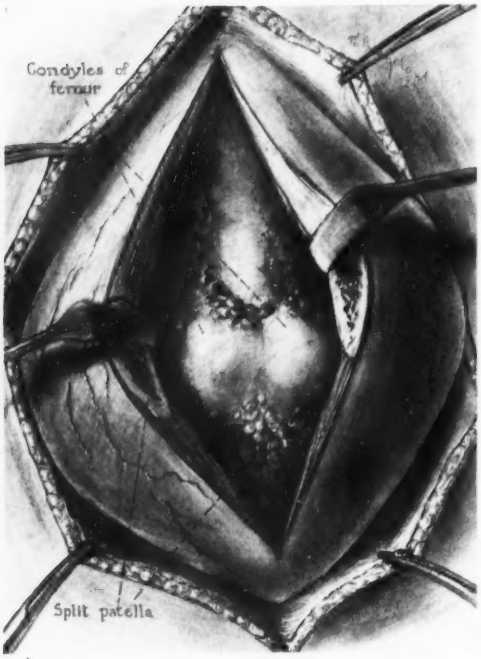

Fig. 8. Case 7. This drawing shows the degree of hypertrophy of the synovial membrane including the ala ligaments.

Fig. 9 (left). Case 7. Photograph which shows the appearance of the left knee 6 months after operation. Note the difference in swelling between the left and right knees. Periarticular thickening is entirely responsible for the remaining swelling.

Fig. 10. Case 7. By measurement with the goniometer, the photograph represents flexion of 75 degrees.

fortnight, and the patient should deviate his body weight from the ligament by walking with his toe turned in—if the measures mentioned fail to restore stability, the reconstruction of the injured ligament should be considered" (2).

The important factor at the outset of such a problem is individualization; if a patient has an injury of the part which has resulted in nothing other than fluid in the joint without an increased range of lateral mobility, a short period of rest followed by physiotherapy will suffice, but when the range of mobility is increased 15 degrees over that of the other knee (and this comparison is important because of the tremendous individual variation in the range of lateral mobility), there is necessarily a severe laceration of the ligament, if not a complete tear. It is impossible to lay down any hard and fast rule, but it would appear in general that such an increase in range of mobility usually is the result of a complete tear of the structure. When this occurs, there is the possibility of interposition of fat, or of the fascial insertion of the sartorius, as in the previously mentioned case, which may prevent nature's producing a sound union. Further, there may be damage to the semilunar cartilage which at an early period after injury can only be determined by visualization. This latter disturbance is perhaps of less importance than a knee with abnormal lateral mobility requiring a late reconstruction which at best rarely gives a result so satisfactory as immediate approximation of the torn structures. Rupture or tear of the crucial ligaments has rarely accompanied the cases which we have encountered. There has been no anterior or posterior displacement of the tibia except in Case 1 where a severe laceration of the posterior capsule occurred and permitted moderate anterior displacement of the tibia. A majority of the damaged crucial ligaments seem to produce no disturbance in function provided that before the part is placed at rest no obstruction to complete flexion and extension is present.

MacGuire (4), following the dissection of several fresh knee joints, found that after

severing the anterior crucial ligament, hyperextension was definitely limited by the lateral ligaments and posterior capsule. Therefore, in the presence of a laceration of the internal lateral and anterior crucial ligaments an early complete repair of the internal lateral ligament produces a stable joint.

We have recently been able to compare the results of four cases treated by immediate suture with a like number subjected to late suture after the patient had walked upon the part for some months. Uniformly there was greater stability in the former group.

It is unfortunate that so many surgeons still feel that the endothelial cells of the synovial membrane have less power to withstand and combat bacteria than have the cells of the peritoneum or pleura. This fear of sepsis by the surgeons has too frequently turned the balance against the patients' receiving adequate and rational therapy.

Moorhead (5) reports a series of 49 cases of arthrotomy for internal derangements of the knee joint with primary union in all cases without stiffness of the joint after operation. During the past 3 years we have operated upon 15 cases of the same type with the same result. Moorhead says further: "Certainly no one could ever accuse the profession of having erred upon the side of too frequent surgery of the knee joint, as has been the case in many other conditions—it might even safely be said that there has been too great conservatism and the patients have suffered the mistake through lack of education of the medical profession."

In view of the increasing number of these acute joint derangements, we should begin to analyze the results of various types of treatment. There has been too great a tendency to resort to mere fixation of the part over a prolonged period without appreciation of the handicaps which have been placed in nature's way of producing a restoration of the lacerated tissues. Those who do not favor immediate suture have contended that the ligament is usually shredded so that adequate approximation and anchorage of the sutures cannot be obtained—this we have found to be the exception rather than the rule. Usually in our experience the tear is a rather sharp transverse one which is easily approximated.

It is hoped that in the near future a series of these cases will be presented from the Orthopedic Services of two institutions; in one all cases with complete lacerations treated by immediate suture, and in the other by fixation and apparatus; only in such a manner can a sufficient number of cases be compiled. Final examination of both groups of patients, if possible, will be made by one who has had no part in the treatment, so that his impression will be entirely unbiased.

CASE 3. No. 109769. *Displaced semilunar cartilage of the left knee; excision of cartilage with complete return of function.*

An adult male, 65 years of age, an official of the Lakeside Hospital, was admitted because of pain in the left knee. His previous history was unimportant. Two months before, while on a camping trip in Colorado, he had stepped down from an elevation of about 12 inches with the left foot; the leg was rotated inward. He noticed a sudden sharp pain in the left knee; he was unable to stand on the leg for several minutes because of pain. The knee became swollen, and during the succeeding week he had seven or eight seizures of acute pain; the major portion seemed to be on the internal aspect, and several times the knee locked. He consulted an orthopedic surgeon in Denver, who first strapped the leg, but on account of the persistence of pain and swelling a plaster cylinder was applied. Upon his arrival here 2 days later, it was suggested that he wear the cylinder for at least 2 weeks. There was persistent pain in the joint for 1 week, during which time he was off the leg. At the expiration of 2 weeks the plaster was removed; there was a small amount of fluid in the joint. Crucial strapping was applied and worn for several days; a considerable amount of fluid reaccumulated in the joint so that it seemed wise to apply a light plaster cylinder which was worn for a period of 3 weeks. Upon removal of this, with crucial strapping, the fluid reaccumulated, and the pain persisted so that it was thought best to remove the cartilage.

The physical examination showed a well developed and well nourished man whose appearance seemed hardly equivalent to his years. The heart, lungs and abdomen were normal. The left knee was slightly swollen. The patella was just ballottable with an increase of one inch in the circumference of the left as compared with that of the right. There was definite tenderness to pressure over the neighborhood of the posterior internal joint space. A complete range of flexion was possible, although it produced considerable pain upon the internal aspect of the knee joint. There was no increase in lateral mobility. The blood pressure was 120—75. The urine and blood were normal. A roentgenogram of the knees showed no evidence of pathology.

He had suffered a varying degree of pain continuously since the injury in spite of the various methods of fixation. In view of the negative roentgenographic findings, the history of locking and tenderness over the internal joint space, a dislocated internal semilunar cartilage was thought most likely.

Following the usual 24-hour pre-operative preparation, the classical incision was made over the internal aspect of the knee. Exposure of the cartilage showed that the posterior cornua was entirely free and rotated underneath the body of the cartilage with a small bulbous tip resting toward the periphery (Fig. 2). The part was removed; the joint otherwise appeared normal. The patient made a normal convalescence. Physiotherapy was begun at the end of one week. Motion of the part gradually increased. Since beginning to walk, the patient has experienced no discomfort. There is a range of 120 degrees of flexion, and the patient is able to attend to his usual duties without discomfort.

It is rather unusual to encounter such a severe and complete tear of a semilunar cartilage in one at the age of 65, since men of this age less often subject themselves to stress and strain which predispose to these injuries. It is of further interest that this patient was never entirely free of pain at any time following the injury. This is easily appreciated when one considers that the posterior cornua of the semilunar was completely folded underneath the body of the cartilage where it remained until removal. This type of pathology is rather unusual, since in an analysis of 117 cases by Robert Jones there were:

2 with the anterior part doubled and adherent
53 torn from the anterior attachment
16 split longitudinally
12 transverse fractures
8 with abnormal mobility
8 attached to the cornua and torn from the capsule
7 displacements of the posterior horn
3 with no evidence of cartilage
8 nodular changes in a free anterior extremity.

Enlargement of the cornua into a bulbous tip is a common behavior following complete tears. The feature of its complete rotation through a sagittal arc of 90 degrees to remain fixed in this position suggests a much more severe degree of trauma than the history in this case indicates, particularly when one remembers that the posterior horn is most firmly attached to the non-articular area between the tibial spine and the attachment of the posterior crucial ligament.

CASE 4. No. 5066. *Loose body in left knee joint; removal of body; complete recovery of function.*

A married white school teacher, 50 years of age, was admitted to the Harbin Hospital on December 3, 1923, with the complaint of pain in the left knee. Her present difficulty appeared 8 years before when for a period of about 3 days she noticed an aching pain in the left knee. It was not particularly troublesome until one year before when moderate swelling of the part appeared. The pain, which was aching in character and localized beneath the patella, kept her awake two nights. There was swelling which persisted for about 3 days. Following this, when walking she frequently noticed a sharp pain in the knee and upon several occasions the part had given way beneath her. Four days before entry she fell, striking the knee against a tree, and at the same time she gave the left leg a slight twist. Swelling appeared and an aching pain kept her awake at night.

The past history was unimportant except for pneumonia 35 years before. Five years previously she had had a mild attack of influenza. Two years before the tonsils were removed because of aching in the knee during atmospheric changes.

The physical examination showed a well developed female. The teeth were good; the tonsillar fossæ were clear; the heart, lungs and abdomen were normal. The left knee was one-half inch greater in circumference than the right with a slight increase in synovial fluid and marked crepitation on motion. A small movable body, which appeared to be about the size of an acorn, could be palpated in the outer capsule of the knee joint. There was moderate periarticular thickening while the range of joint motion was normal. The urine and blood were normal. Roentgenograms of the knee showed some sharpening of the spines of the tibial tuberosities with a globular shadow of increased density in the outer joint space. The left knee was explored for the loose body. Following an 18-hour preparation of the skin with alcohol and bichloride and under ether anæsthesia, a linear incision 2 inches in length was made lateral to the patella. Through the subcutaneous tissue the loose body could be palpated. It was transfixed with a Wythe pin and the incision was carried down upon it. The body was free in the joint and about 1 centimeter in diameter. Exploration of the joint failed to reveal other loose bodies present. The wound was closed in the usual manner.

The postoperative course was uneventful, and the patient was discharged 10 days following operation.

A follow-up letter in September, 1926 stated: "I never think of my knee and have not had to consult a doctor for it since you dismissed me from your care."

CASE 5. No. 110970. *Osteochondritis dissecans, hypertrophied infrapatellar fat pad; removal of loose bodies; excision of infrapatellar fat pad; complete recovery of function.*

A married Italian street peddler, 47 years of age, entered the Lakeside hospital December, 1925, with the complaint of pain in the right knee. His disability began 2 years before when upon stepping down from the curb he felt a sudden, sharp pain

upon the inner lateral aspect of the right knee joint. This pain remained localized, was somewhat sharp in character and was exaggerated by motion and weight bearing. The knee immediately became swollen and was so painful that his activities were limited. The pain slowly subsided until 1 week before entry when it recurred and forced him to bed. Climbing stairs produced the maximum amount of pain. There was no history of locking.

His past history was rather unimportant. There was no history of trauma except that 1 year previously he had bumped the right knee against the brake handle of a Ford truck, which produced soreness for only 2 days. He was the father of a family of seven children, all living and well. There was no history of previous infection. He denied venereal disease.

The physical examination was unimportant except for the right knee which was 4 centimeters greater in circumference than the left. The patella was ballottable. Slight increase in surface heat was present, but no redness. Moderate tenderness to pressure existed over the region of the internal joint space with crepitation upon motion. Flexion caused considerable pain beneath the patella and was limited about 60 degrees. There was complete extension with no increased lateral mobility. Careful searching failed to reveal any foci of infection. Roentgenograms showed two small calcified bodies in the lateral surface of the joint space with an area of irregularity and decreased density 1.5 centimeters in diameter over the inner condyle of the femur, and also a rather smooth shadow of increased density extending from the lateral cortex of the upper tibia below the epiphyseal line. The latter suggested an osteoma. Aspiration of 10 cubic centimeters of fluid from the knee showed a cloudy, straw-colored, rather viscid fluid. A smear showed about eight large mononuclear cells per high power field. Cultures and guinea pig inoculation were negative. An arthropneumogram was made at this time which showed the hypertrophied infrapatellar fat pad and the loose bodies quite clearly (Figs. 3 and 4). The temperature, white blood count and urine were normal. A diagnosis of osteochondritis dissecans and hypertrophied infrapatellar fat pad was made.

The knee joint was exposed through a patella-splitting incision which revealed a rather hyperæmic synovial membrane with villus tabs throughout the joint (Fig. 5). A loose body was found free in the infrapatellar portion of the joint about the size of a small butter bean. There was a multiplicity of tabs hanging free in the joint. The ala ligaments and the ligamentum mucosum were markedly hypertrophied. There was an irregular area of erosion extending about 7 millimeters in depth and 1 centimeter in diameter upon the inferior mesial condyle of the femur. The larger fibrous tabs were excised, together with the infrapatellar fat pad. A complete synovectomy was not done. The joint was closed in the usual manner. The patient made a normal postoperative convalescence. The wound healed *per primam*. Histological examination of the loose body showed hyaline cartilage and a considerable quantity of white fibrous connective tissue with a fairly extensive infiltration of soft tissue by small lymphocytes.

The patient was in the hospital for a period of 3 weeks. Physiotherapy was begun 10 days after operation. The patient returned to his work at the end of a month following operation, and a follow-up letter from him 2 years after operation stated that he could not return to the dispensary because of his work, that he had had no pain or disability in the knee since operation.

CASE 6. No. 115277. *Loose bodies in right knee joint with flexion deformity of the joint; hypertrophic osteo-arthritis; exploration of the knee joint; removal of loose bodies; correction of the flexion deformity with complete recovery of function.*

A married white female, 50 years of age, was referred to the hospital September 12, 1926, because of severe pain and locking of the right knee. She was perfectly well until 2 years before when a sudden sharp pain appeared upon the internal aspect of the right knee joint. It was distinctly worse upon walking and occasionally kept her awake at night. The knee became swollen shortly after the initial pain, and because of this pain she consulted a bone-setter without relief. Later a physician was consulted who treated her with diathermy for several weeks without improvement. A chiropractor was then seen who manipulated and massaged the part. She maintained that there was complete relief for a period of 4 months afterward. Following this, however, motion again became painful and up to the time of admission there had been intermittent swelling of the part. Prolonged periods of rest gave relief. During the preceding 3 months, the knee had occasionally locked and the part had become progressively flexed.

Her past history was unimportant, except for pain in the left arm 2 years before which was considered to be "neuritis." There had been a moderate degree of constipation. Roentgenograms of the teeth at this time showed two suggestive areas of absorption.

The physical examination showed a female of average height, somewhat overweight. There were many crowns upon the teeth with moderate gingivitis. The tonsils were atrophic and somewhat injected. The heart, lungs, and abdomen were normal. The upper extremities and left leg appeared to be normal, while there was about 5 centimeters of atrophy of the right thigh and calf. The knee was flexed at an angle of 35 degrees from a straight line; extension beyond this point was impossible. There was moderate crepitation and the patella was displaced somewhat toward the outer condyle of the femur. The part showed a moderate genu valgum with thickening of the periarticular structures, especially in the neighborhood of the infrapatellar region and some tenderness in the neighborhood of the suprapatellar pouch. Deep pressure elicited an irregular resistance which suggested loose bodies. She was able to walk with the knee flexed.

Roentgenograms of the knee showed hypertrophic changes of the joint (Figs. 6 and 7). There were

several calcified masses in the upper outer suprapatellar pouch. The urine and blood were normal. The renal function was 55 per cent in 2 hours. The blood pressure was 150—90.

In view of the considerable disability which the patient suffered, it seemed wise to remove the loose bodies which were present and stretch the knee into extension.

The skin over the region of the knee was prepared 24 hours before operation. The joint was exposed by the patella-splitting incision. The synovial membrane showed considerable œdema and hyperæmia. The suprapatellar pouch in its mesial portion was obliterated; three free bodies, each about the size of a small pecan, were found in the outer suprapatellar pouch. Three other bodies about the size of small peas were found hanging by narrow pedicles. There was almost an entire absence of cartilage beneath the patella and over the condyles of the femur. The semilunar cartilages were intact, although the mesial one was somewhat flattened and sclerotic. Multiple small bodies about the size of a pin-head hanging from small shreds were present throughout the synovial cavity. A moderate sized portion of hypertrophied infrapatellar fat pad was excised. The leg was stretched out to complete extension and the part placed in a plaster cylinder. The patient made an uneventful postoperative convalescence. Physiotherapy was begun at the end of 10 days with gradual increase in weight bearing. She rapidly regained use of the part, and was able to walk without support 3 weeks after operation. The patient was seen one year following operation, and she stated that she had had no discomfort or pain in the knee since leaving the hospital; the range of motion was complete.

CASE 7. No. 117689. *Osteo-arthritis (villous type) of knees; synovectomy of left knee with relief of pain and swelling.*

A white male, 32 years of age, entered the Lakeside Hospital February 27, 1927, with the complaint of pain and swelling of both knees. He had been perfectly well until February 21, 1912, when he noticed pain in the left knee. It was quite severe, but he continued with his work that day. During the evening the pain became more severe; he had a chill and was feverish. For several days previously, he had had a cold which gradually improved. Two days after onset of pain in the left knee the same condition developed in the right knee. He consulted a doctor 5 days after the onset. Fluid was withdrawn from the left knee, and he stated that it was clear and amber in color. The fluid recurred and the pain persisted. Local heat was applied without relief. On March 1, he entered the hospital where he remained for 3 months. He was given a vaccine which produced considerable reaction following which there was definite improvement in both knees. He was discharged from the hospital at the end of 3 months. The knees were still swollen and somewhat stiff.

Three months later roentgenograms were taken which he claimed showed no evidence of disease. He returned to work in a bakery about this time and was able to carry on with his work until the cold weather, when pain and swelling recurred. Various types of physiotherapy were tried without much relief during the succeeding year, and because of the severe pain he was given morphine by the doctor, and this subsequently resulted in morphine addiction; he took from 8 to 10 grains a day until a few months before admission when he discontinued the habit voluntarily. The pain and swelling in the knees had persisted with little change to the time of admission. He entered the hospital with this complaint.

His past history revealed that at the age of 7 years he was hit in the right eye with resulting loss of vision. The second toe of each foot had been amputated for hammer-toe a number of years before. During the past 10 years he had had a chronic productive cough which had been worse in winter. In 1911 he had a gonorrhœal urethritis which cleared up within 3 weeks and parotitis in 1920 without any complication. There had been a loss of 10 to 15 pounds during the preceding month.

The physical examination showed a well developed somewhat poorly nourished male. The lens of the right eye was very opaque with complete blindness; the left pupil was quite regular and reacted to light and distance. The heart, lungs, and abdomen were normal. Both knees showed a marked fusiform swelling and the patellæ floated. The knees were limited to within 10 degrees of complete extension with a range of about 80 degrees of flexion. Palpation revealed no areas of tenderness, but irregular bodies, which moved freely beneath the palpating finger, could be felt in the lateral suprapatellar pouch.

The roentgenograms of the teeth and chest showed no evidence of pathology, while films of the knees showed some obliteration of the joint space with partial calcification of the right external semilunar cartilage, and sharp tibial spines. The blood pressure was 110—65.

The fluid from the knee was straw colored and contained many round cells. The culture was negative. Guinea pig inoculation failed to show tuberculosis. Prostatic smears showed a few leucocytes but no intracellular diplococci. The sputum showed no tubercle bacilli. The blood Wassermann and Wassermann upon fluid from the knee were negative. The urine was normal upon two examinations. The leucocytes numbered 7,000; erythrocytes, 4,350,000 and hæmoglobin 80 per cent. A lumbar puncture showed normal intraspinal pressure, clear fluid, 4 cells, no globulin, and the spinal fluid Wassermann was negative. It was thought that his disability resulted from a villus arthritis, and in view of the persistence of the disturbance the radical procedure of a synovectomy of the left knee seemed indicated.

Under spinal anæsthesia a 7-inch patella-splitting incision was made over the left knee (Fig. 8). Exposure of the joint revealed a large amount of clear amber fluid. There was marked villus hypertrophy

of the synovial membrane scattered throughout the entire joint. The cartilaginous covering of the condyles, patella, and tibia appeared relatively normal. The hypertrophic tabs were excised and all of the accessible hyperæmic synovial membrane was curetted. The infrapatellar fat pad was excised. The tourniquet was removed and the wound was sutured in the usual manner. A plaster splint was applied from the groin to the toes with the knee in 15 degrees of flexion.

The patient made a satisfactory convalescence except for a rather high rise of temperature which reached 39.5 degrees C. on the third day after operation. Within 7 days, however, it had descended to normal. The wound healed *per primam*. Physiotherapy was begun at 10 days after operation. In 2 weeks the patient was allowed up with crutches and was allowed gradual weight bearing until 4 weeks after operation when the crutches were discarded. He was discharged from the hospital on April 1, after a period of 34 days in the hospital.

The histological examination of the tissue showed multiple foci of lymphoid cells surrounded by a deposit of loose connective tissue. Certain sections showed papillomatous processes cut in cross section and richly infiltrated with leucocytes and round cells. The pathological diagnosis was subacute and chronic inflammation, non-tuberculous in character.

Unfortunately, it was impossible for this patient to have physiotherapy after leaving the hospital. His ability to walk gradually increased; there was no reaccumulation of fluid in the joint and no pain. In view of the marked improvement in the left knee, the patient returned to the hospital July, 1927, with a request for the same operation upon the right knee. At this time the left knee showed only periarticular thickening without fluid (Figs. 9 and 10); it was painless and there was a range of 75 degrees of flexion.

It is not the purpose of this paper to classify or to discuss the various types of arthritis. It so happens that several of the above cases in which loose bodies were present occurred in patients with an obvious proliferative type of arthritis, and so far as terminology shall be spoken of under the rather general name of osteo-arthritis; in our experience, by far the greater proportion of the patients with loose bodies in the knee have osteo-arthritis. We are here interested primarily in the surgical aspect of this disturbance, realizing that in these cases with advanced bone change it is rarely, if ever, possible to eradicate the disease completely. In properly selected cases, however, it is possible to give complete relief, while in others function can be tremendously improved.

In all of our cases there has been a definite degree of improvement. A search for the etiology of the osteo-arthritic changes was carried out most thoroughly in all cases, but since this is primarily a consideration of the surgical aspect, etiology was not discussed. One of our most gratifying results occurred in a patient who had been incapacitated for 4 months, unable to get around except by the aid of crutches, without any use of the right leg because of severe pain beneath the patella upon usage. The roentgenograms failed to show anything other than some atrophy and sharpening of the tibial spines and tuberosities. All previous measures, such as physiotherapy and apparatus, had failed to give relief; with certain misgivings the joint was explored through a patella-splitting incision and nothing other than a hypertrophied infrapatellar fat fringe was found to account for the pain. This was excised. It has now been 6 years since operation, and the patient reported a short time ago that there had been no discomfort or disability in the knee since operation.

Very little emphasis has been placed upon the frequency with which loose bodies occur in the knees of patients with osteo-arthritis; further there has been a lack of enthusiasm for their removal. Recently several cases have been encountered where loose bodies have been responsible for a complete disability, and their removal has resulted in a complete return of painless function. The period of postoperative recovery has been short, the wounds have all healed *per primam* and the stay in the hospital has rarely exceeded three weeks.

The incidence of occurrence of true osteochondritis dissecans has been very low, so that our attention here is largely directed toward the osteo-arthritic type. Case 4 showed such slight changes in the joint that it might have been classified as a true osteochondritis dissecans, although the sharpening of the spinous processes was thought to represent a mild osteo-arthritis. Senile changes in joints as presented by the roentgenograms are frequently difficult to differentiate from a mild osteo-arthritis, and the presence of symptoms of osteo-arthritis is often the deciding factor. It was impossible in this case to say whether trauma played a part in production of the

body; the singularity of the body, the lack of visible gross changes in the joint and the fact that within 4 years the patient has had no further trouble would strongly suggest that it might have been traumatic in origin. This loose body was free in the joint, quite smooth and ovoid in outline; there was microscopic evidence of cartilage and fibrous tissue. Bodies of this type tend to occur in pouches or recesses of the synovial membrane where they remain without change of position; they may reach a large size. Because of their tendency to remain in one position, they rarely cause symptoms and are often discovered accidentally.

The loose body which occurred in Case 5 probably arose from the cartilage and should be termed a synovial chondroma.

The extraordinary degree of hypertrophic changes in Case 6 are quite striking as well as the early return of satisfactory function. The history is quite interesting; the disability extended over a period of 2 years, during which time she had practically every form of therapy with brief periods of relief until the deformity plus the discomfort finally forced inactivity. An illustration of the attitude of the medical profession toward surgical interference was brought forcibly to our attention in this case. Shortly before coming into the hospital, she had consulted a nationally prominent internist who had advised that if the loose bodies were removed, the knee joint would certainly be stiff. There is little necessity for detailed discussion of the pathology in this case since it is a rather ordinary type of hypertrophic osteo-arthritis, except for the unusual number and size of loose bodies present. Unfortunately the artist was not asked to make drawings of the bodies, but an idea of their relative size can be gained from the roentgenographic appearance. Since no definite etiology could be demonstrated at the time for the osteo-arthritic changes, and in view of the numerous synovial tabs, it was felt that an early recurrence might take place. It has now been one year since operation and no signs have appeared.

Case 7 is an example of a prolonged disability which had resisted every possible form of conservative therapy. The patient had become worthless to himself as well as to society and to make matters worse during the course of his discomfort had become a morphine addict following the administration of a few doses by a doctor for the relief of the pain. Both knees presented massive swelling the result of villous hypertrophy with a large amount of fluid while the articulating portions of the joints were relatively normal. It is interesting to note that such a process can persist in *statu quo* for such a long period. There was little choice of therapy since everything except actual removal of the offending synovial membrane had been tried without satisfactory improvement. Further, it was not possible to unearth any factor outside the joints which might have been responsible for the disturbance, other than the history of an old chronic bronchitis. The blood Wassermann did not seem sufficient, and thus the fluid from the knee was tested with a negative result. This case then appeared to be an excellent one for synovectomy at least as a trial procedure upon one knee. Since Key's (3) experimental work upon synovial regeneration we have approached these problems with less hesitancy, although as yet we are unable to understand why the regenerated synovial cells should differ from their predecessors in their behavior. A pre-existing focus of infection or disturbed metabolism might produce the abnormal behavior of the cells later to be corrected; at any rate before the regenerated cells begin their function. This explanation will not fit all cases and to postulate that there is less tendency for proliferation and hyperactivity of cells following injury is contrary to the physiologic activity manifested in other tissues, for when there is demand for repair, during the early stages particularly, the quantity of cells is usually in excess of the normal requirement. The result in this case was highly satisfactory; the excess fluid and the pain were completely relieved while there was a range of 70 degrees of painless motion. The operation afforded such relief that the patient voluntarily requested the same treatment for the other knee; this was carried out only a short time ago and promises a better result than the former operation because of a greater range of motion.

SUMMARY

The primary purpose of this paper is to emphasize the importance of early surgical correction of complete lacerations of the internal lateral ligament and capsular tears of the knee joint in preference to fixation and apparatus alone. There has been a considerable increase in the incidence of these injuries due to the greater number of automobile accidents. Late repair is rarely so satisfactory as the immediate approximation of the torn structures and further it is the impression that these patients so treated suffer a shorter period of disability. Two representative cases from a group of 16 are reported in detail. An unusual laceration of the posterior cornua of an internal semi-lunar cartilage is discussed; the persistent pain even with the part fixed was explained by the position of the torn cornua. Removal of the cartilage gave complete relief.

Several different types of loose bodies in the knee joint are considered; their removal resulted in complete return of function. Synovectomy of the knee joint is considered; a patient with villous arthritis and hydrops was subjected to this type of operation and satisfactory results were obtained.

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THE EFFECT OF IODINE AND THYROID FEEDING ON THE THYROID GLAND

An Experimental Study[1]

By W. B. MOSSER, M.D., Philadelphia
William H. Bennett Fellow in Surgery

FOR several years we have accepted Plummer's theory as an explanation of the effect of iodine on the course of hyperthyroidism. He believes that the toxic goiter secretes an abnormal substance, which has been designated deiodized thyroxin, and that iodine exerts its beneficial effect by supplying the iodine radical to this substance.

Recent investigations, however, have cast considerable doubt on Plummer's theory, as the following facts attest:

1. The theoretical abnormal substance has not been isolated; its chemical formula is unknown.

2. The theory fails to explain the relapse following an initial temporary improvement when iodine is given to patients with hyperthyroidism.

3. Several observers have demonstrated that the picture of hyperthyroidism can be constantly produced in the experimental animal by intravenous administration of normal thyroxin (3, 5).

4. Administration of iodine has no effect on the course of experimental hyperthyroidism, i.e., there is no effect on the circulating thyrotoxic substance (3, 5).

5. The studies of Reinhoff and Cattell, who took specimens from patients before and after iodine medication have shown that an involutional change occurs in the gland itself (1, 4).

In view of this evidence, it becomes increasingly more difficult to accept Plummer's theory. It is certainly much more logical to assume that iodine exerts its effect at the seat of production of the thyrotoxic substance than on the circulating toxin. It was, therefore, to determine something concerning the effect of iodine on the thyroid gland under various conditions, that the following studies were made.

Adult dogs that had been fed the usual animal house mixed diet for several days were used. During the observation period they were kept on this diet, which was varied only by including iodine or thyroid extract. Small specimens were removed from the thyroid gland at the beginning of the observation period, at intervals after giving medication, and several months after the drugs were discontinued.

Group 1. After a section had been removed for microscopic examination, the dogs were given iodine in the form of Lugol's solution, 10 minims daily for 6 weeks, at the end of which time a second biopsy was done. After an interval of several months, during which no medication was given, another biopsy was done.

Group 2. After preliminary biopsy, the animals were given thyroid extract in increasing quantities until they exhibited symptoms of hyperthyroidism. A second section was taken. Iodine was then given for 6 weeks, at the end of which time a third section was taken. After a rest period of 3 months, a fourth section was taken.

Group 3. In this group the rotation of drugs was similar to that in Group 2 except that the thyroid extract was continued during the 6 week period that the animals received iodine.

RESULTS

The histological picture of the specimens removed from different animals after similar rotation of medication showed considerable variation, the most frequent variation being an absence of the typical iodine effect. As a rule, however, the histological picture was similar to that seen in the photomicrographs here presented.

Group 1. Figures 1 and 2 are photomicrographs of the low and high magnification of the thyroid gland of a normal dog. Figures 3

[1] From the Departments of Surgery and Research Surgery; University of Pennsylvania, School of Medicine.

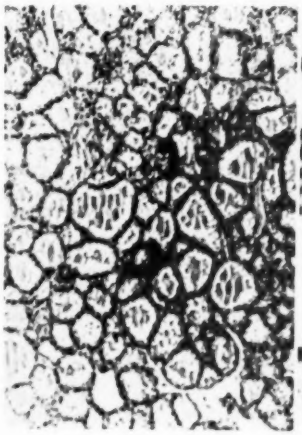
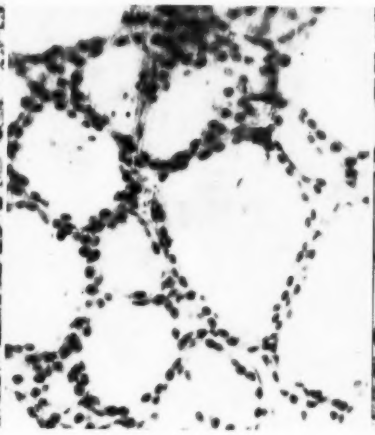


Fig. 1.



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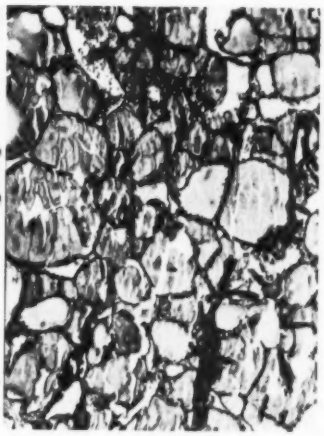


Fig. 3.

Fig. 4.

Fig. 5.

Fig. 1. Normal thyroid gland of dog. Low power.
Fig. 2. Same. High power.
Fig. 3. Section from same animal, after being fed iodine for 6 weeks. Low power.
Fig. 4. High power photomicrograph of same section as shown in Figure 3.
Fig. 5. Same animal after a rest period of 5 months. Low power.

and 4 are from the same dog after receiving iodine for 6 weeks. As compared to the normal gland, it will be noted that the acini are distended with colloid and, when seen under higher magnification, the cells lining the acini are distinctly flattened. It is reasonable to assume that the ingestion of iodine has produced an increase in the amount of colloid which in turn has produced by compression a very evident distortion of the cells. This condition may persist for a considerable length of time as shown in Figure 5, which is a section from the same animal taken after a rest period of 5 months.

Group 2. A normal section is shown in Figure 6. After receiving thyroid extract for 1 month the sections shown in Figures 7 and 8 (low and high power) were taken. It

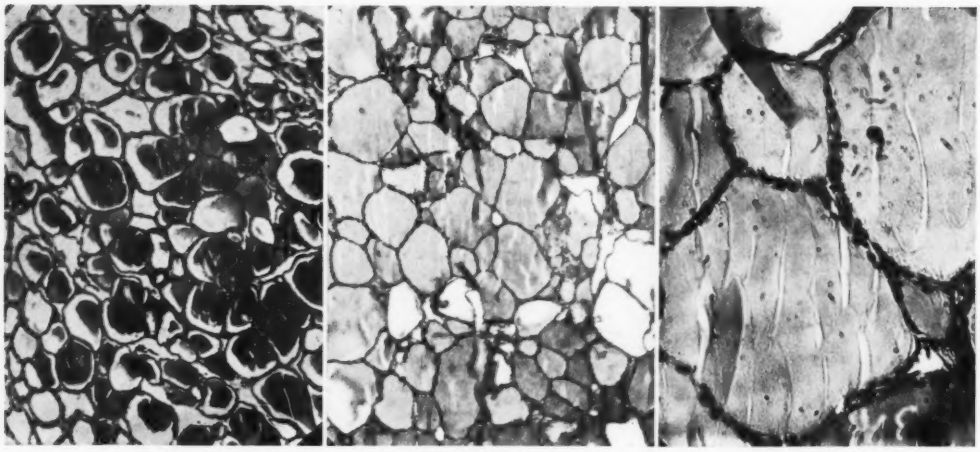


Fig. 6. Fig. 7. Fig. 8.

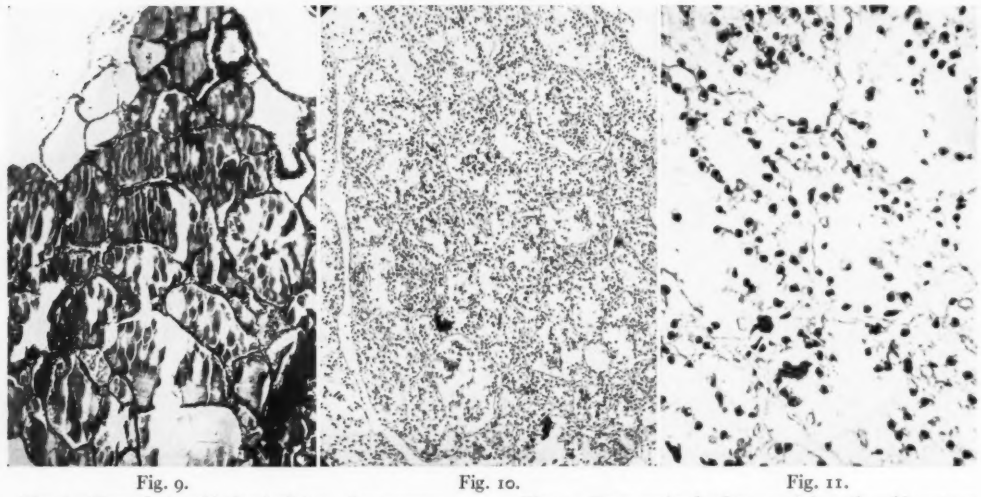


Fig. 9. Fig. 10. Fig. 11.

Fig. 6. Normal thyroid gland of dog. Low power.
Fig. 7. Same animal after feeding thyroid extract 4 weeks. Low power.
Fig. 8. Same. High power.
Fig. 9. Same animal after receiving thyroid extract 4 weeks and iodine 6 weeks. Low power.
Fig. 10. Same animal after a rest period of 3 months.
Fig. 11. Same. High power.

will be noted that the effect of thyroid extract is practically identical with that of iodine (Figs. 3 and 4), i.e., the acini are distended with colloid, and the lining cells are compressed. The thyroid extract was then discontinued and iodine was given for 6 weeks, at the end of which time a section was taken (Fig. 9). This section shows practically no change from that taken after thyroid medication. In a few of the sections, the amount of colloid was slightly increased. All medication was then stopped for 3 months. At the end of this period, sections were again taken (Figs. 10 and 11). The morphological change in these sections is very striking. When compared to the normal gland of the same animal (Fig. 6), there is no similarity of structure. The amount of colloid is greatly

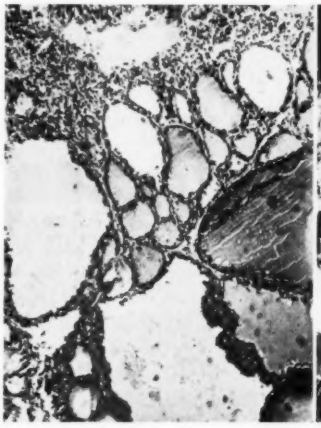
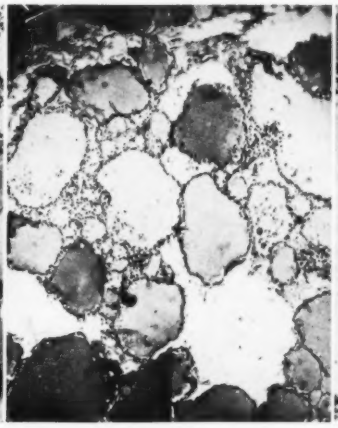


Fig. 12.



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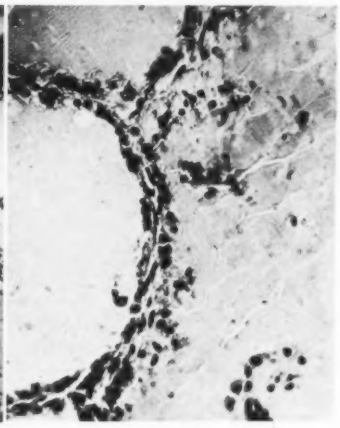
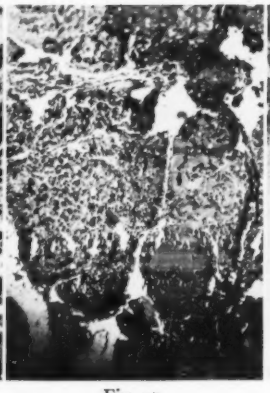


Fig. 14.

Fig. 15.

Fig. 16.



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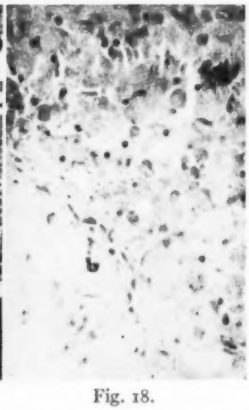

Fig. 18.

Fig. 12. Effect of iodine ingestion on a normal human thyroid.

Fig. 13. Typical effect of iodine on hyperplastic toxic goiter. Low power.

Fig. 14. Same. High power.

Fig. 15. Section showing the effect which the prolonged administration of iodine has upon hyperplastic toxic goiter. Low power.

Fig. 16. Same. High power.

Fig. 17. Effect of prolonged iodine administration on hyperplastic toxic goiter. Low power.

Fig. 18. Same. High power.

diminished. The cells are detached and lie free in the acini. Under higher magnification the cells are granular and the cytoplasm is vacuolated. This stage, which occurred very frequently after prolonged administration of thyroid extract and iodine, was interpreted as a period of exhaustion.

Group 3. In this group, the same morphological changes occurred as in the previous group. The stage of exhaustion was identical with that produced in the dogs in Group 2.

Interpretation of results. We are justified in concluding from the examination of the various specimens that iodine stimulates the gland to produce colloid. This process continues during the stage of experimental hyperthyroidism. As the colloid increases, the cells are compressed and flattened. This mechanical compression may very possibly prohibit, at least temporarily, the usual secretory function of the cells. After prolonged administration of iodine and thyroid

extract, the cells become exhausted, show changes of degeneration, and are no longer capable of producing colloid.

EFFECT OF IODINE ON THE HYPERPLASTIC TOXIC GOITER

The morphological changes produced by the administration of iodine to patients with primary hyperthyroidism have been well described. The acini are usually distended with colloid. The cells are transformed from columnar to low cuboidal and often are exfoliated and degenerated.

It is interesting to note the effect of iodine on a normal human thyroid, as shown in Figure 12. The acini are distended and the cells have changed from a columnar to a cuboidal type. The effect is quite similar to that produced in the experimental animal after iodine feeding (Figs. 1 and 2).

The typical effect in toxic patients who have been operated upon during the stage of maximum improvement is shown in Figures 13 and 14.

The most interesting group of patients from the standpoint of the present study are those who have taken iodine for a prolonged period of time and who have come to operation after they have escaped from its benefit. Microscopic examination of these specimens shows a maximum effect of iodine. The cells are often degenerated, exfoliated and vacuolated. Clinically, however, the patients at the time of operation are often extremely toxic and represent a considerable surgical risk. Figures 15 and 16 (low and high power) are from a patient who took iodine continuously for 18 months. During her pre-operative hospitalization the basal rate dropped 11 points. At the time of operation, she was considered a serious risk, although the section shows a maximum effect of iodine. Figures 17 and 18 are from a similar case. The patient took iodine at intervals for several months prior to operation.

If the sections from these patients who took iodine for several months are examined carefully (Figs. 15, 16, 17, 18), a striking resemblance to the section taken from a dog after prolonged iodine and thyroid medication is seen (Figs. 10 and 11). It would seem that prolonged iodine administration in these patients has produced a stage of exhaustion in the gland similar to that produced in the experimental animal.

Consideration of the facts here presented is, I believe, sufficient basis for a theory to explain the action of iodine on the toxic goiter. When iodine is first given the cells are stimulated to secrete an excessive amount of colloid. This colloid fills the acini and mechanically compresses the lining cells, thus reducing their secretory power. Less thyroxin is produced, and the patient shows clinical improvement. Gradually the cells adjust themselves to the changed condition and resume their secretory power. The amount of thyroxin is thus again increased and the toxic symptoms increase proportionately. Further iodine medication fails to alter the production of thyroxin, but does continue to stimulate colloid production. After prolonged iodine administration the cells become exhausted, can no longer produce colloid, and on continual iodine stimulation they degenerate. However, even in the stage of exhaustion, they are still quite capable of carrying out their pathological function, i.e., production of excessive amounts of thyroxin. The microscopic picture, which is usually interpreted as a specific effect of iodine on the thyrotoxic producing properties of the cells, is in reality the effect of prolonged and excessive colloid production.

It is an interesting coincidence that DeCourcy (2) from clinical observations has arrived at the same conclusion regarding the effect of iodine as is here presented.

CONCLUSIONS

1. In the experimental animal iodine stimulates the cells to produce colloid.

2. Colloid retention compresses and flattens the cells of the acini.

3. The same effect occurs from iodine administration in the presence of experimental hyperthyroidism.

4. Prolonged iodine administration to a hyperthyroid anima' produces a stage of exhaustion in the gland.

5. The effect of iodine on the normal gland is similar to that in the animal.

6. The effect of iodine on the hyperplastic toxic goiter is similar to that obtained in the normal gland of the dog.

7. After prolonged administration of iodine (3 to 12 months) to the patient with hyperplastic toxic goiter, a stage of exhaustion is noted. This is similar to that produced in the animal by prolonged feeding with thyroid extract and iodine.

8. The clinical status of the patient is not proportionate to the histological picture when iodine has been taken for a prolonged period.

9. A theory to explain the action of iodine in the patient suffering with hyperthyroidism is presented.

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MORPHOLOGICAL CHANGES IN EXOPHTHALMIC GOITER FOLLOWING THE USE OF LUGOL'S SOLUTION

By C. ALEXANDER HELLWIG, M.D., Wichita, Kansas
From the Laboratory of the Halstead Hospital, Halstead, Kansas

IT is now generally recognized that in every case of Graves' disease the thyroid gland shows constant pathological changes. Many authors agree that the microscopic picture runs parallel with the clinical course. When Plummer proved that the administration of Lugol's solution was followed by a striking remission in the toxic symptoms, a search was at once begun for an anatomical basis for this fact.

Rienhoff, Cattell, and Giordano, in this country, and Merke, in Switzerland, concluded that after iodine medication the exophthalmic goiter shows such a high grade of involution that it resembles the normal gland or colloid goiter. In seven cases of severe exophthalmic goiter, Rienhoff removed a portion of the gland before any medical treatment was given and compared it with the gland which was later resected after the administration of iodine. Merke likewise made a comparison of tissue removed from the same gland before and after Plummer's treatment, but his first excision was combined with ligation of two or more thyroid arteries.

Rienhoff's method is ideal if he succeeded in making the first excision without ligating any of the thyroid arteries. It is difficult to understand how he could remove a large portion of the gland including the whole upper pole without interfering with the blood supply. We know that ligation of the thyroid vessels causes changes similar to those described by Rienhoff. This being the case, it is necessary to use great care in drawing conclusions from such methods. Another source of error that must be taken into account is that the same exophthalmic goiter may show entirely different microscopic pictures in various portions of the gland.

In our study we examined slides from 30 patients who had not received Lugol's solution prior to operation and from an equal number of patients who had been given Lugol's solution before operation.

The first series was studied to establish a basis for comparison. All of the cases presented the complete clinical picture of Graves' disease, but the duration and severity of the clinical symptoms varied. In the second series in which Plummer's method of treatment was used, various grades of toxicity were present, so we did not follow Giordano who selected for comparison only the thyroid glands of patients dying during thyrocrisis.

Most authors make a sharp distinction between primary and secondary exophthalmic goiter. The expediency of this division is questionable. From my own studies, not alone of these 60 glands but also of many glands from patients of European extraction, I am forced to the belief that exophthalmic goiter

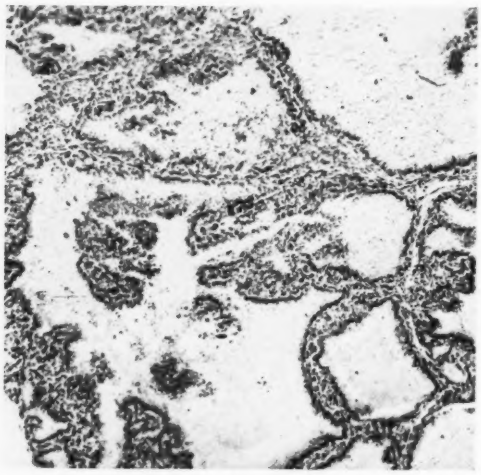

Fig. 1. Exophthalmic goiter removed from a patient, 24 years old, who had not received Lugol's solution. Duration of Graves' disease 2 months. Large irregular acini with marked proliferation of the epithelial wall are seen. Group I.

develops usually in a diffuse colloid goiter. In 37 per cent of the glands in my first series the patients had not received iodine and the glands did not present the classical diffuse, meaty, dry appearance on the cut surface but were amber red and translucent, either throughout or in patches here and there, suggesting a colloid-rich tissue. In nearly 85 per cent of the glands, groups of lumina could be

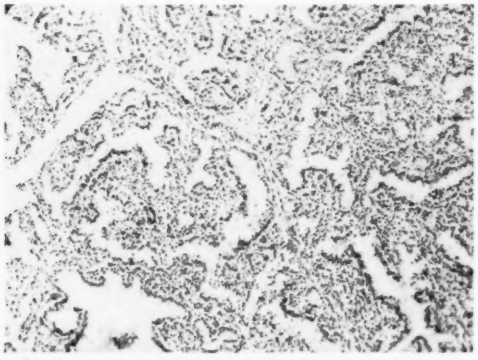

Fig. 3. Exophthalmic goiter of Group III. Duration of symptoms 3 years, no administration of iodine. Marked epithelial proliferation. The narrow, empty acini are regarded as rests of the former wide lumina of the colloid goiter.

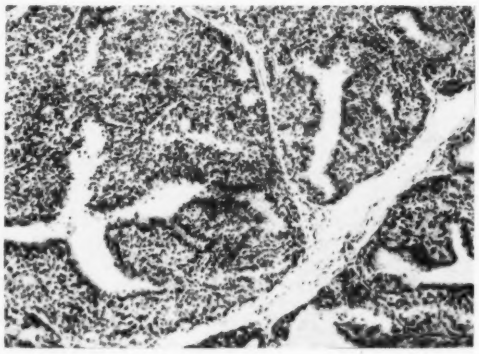

Fig. 2. Exophthalmic goiter from a patient aged 34 years. No administration of iodine. Toxic symptoms for 7 months. The slide represents the type of cell proliferation in Group II, the second stage of development of exophthalmic goiter. The acini are narrow and polymorphous, the foldings of the wall being higher and abundant. The acini are free from colloid.

distinguished with the unaided eye. These lumina represented large colloid-containing follicles such as one never sees in the normal gland, but which are characteristic in the diffuse colloid goiter. Even in glands with uniform, dry, meaty cut surface these lumina were seldom missing.

Likewise the distinction usually made clinically between innocent colloid and exophthalmic goiter does not seem to be justified, since the diffuse colloid goiter, at least the proliferating form, is often associated with slight symptoms of hyperthyroidism. In his treatise

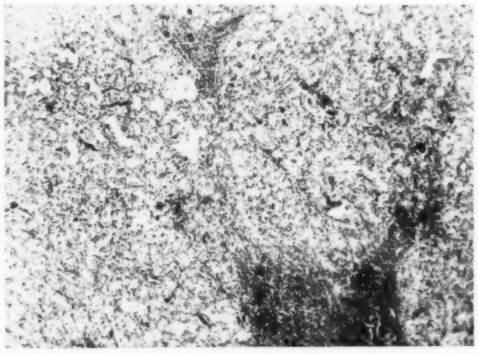

Fig. 4. Solid type of exophthalmic goiter, Group IV. No administration of iodine. Patient 26 years old, ill for 3 years.

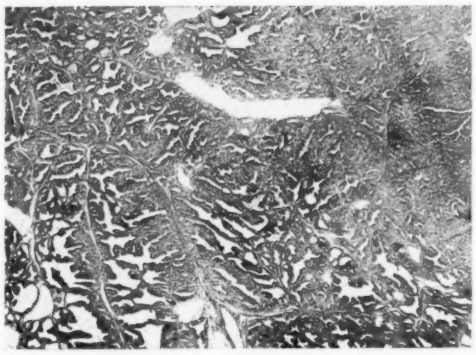

Fig. 5. Section from exophthalmic goiter removed from girl 15 years old who had not received the Plummer treatment. We find the transitional stages from colloid to exophthalmic goiter; large round follicles, branched narrow ducts, and solid areas. The acini appear empty.

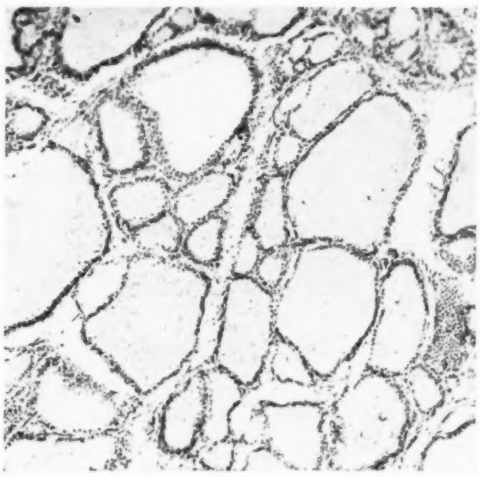

Fig. 6. Exophthalmic goiter removed after 13 days of the Plummer treatment. The goiter belongs to Group I. The large acini are filled with well stained colloid.

on diseases of the thyroid gland, Hertzler mentions that he often saw slight toxic symptoms in young people who were developing colloid goiter, and in his recent article on classification of goiters he brings out clearly the relationship between colloid and exophthalmic goiter.

From their microscopic appearance, the glands of our first series can be grouped in four different stages of hyperplasia:

Group I. Diffuse colloid goiter with marked epithelial proliferation (Fig. 1). The 9 cases which belonged to this first group had toxic symptoms only a short time or only in a moderate degree of severity. Microscopically, the acini of these glands were much larger than were those in the normal gland and were extremely irregular in form because the epithelial wall extended into the lumen. These elevations of the wall were covered by a high epithelium with slender crowded nuclei, which stained deeply, while the remaining circumference of the follicle still exhibited a cuboidal epithelium. The colloid was markedly diminished in amount and altered in quality. The normal eosinophile refractive material was replaced by a very pale staining vacuolated substance. In two cases the content of the acini had not taken any stain and the lumina appeared empty.

Group II. The second stage of development of the lesion. The acini in the four glands in this group were narrower and still more polymorphous than were those in the first stage, because the elevations and foldings of the wall were higher and abundant. The epithelium of the whole circumference of the acinus was columnar. Beneath the epithelial lining of

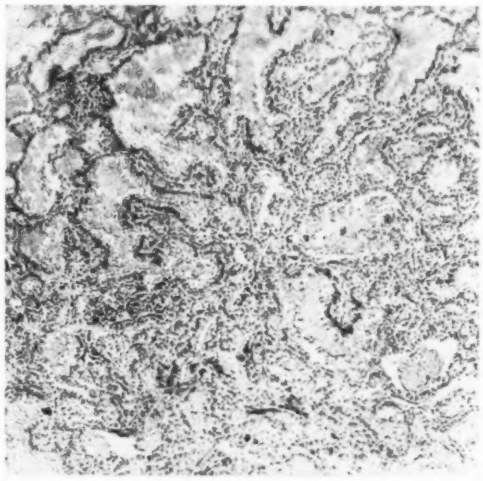

Fig. 7. Exophthalmic goiter removed after 12 days of Plummer treatment. Colloid filled with acini, marked epithelial proliferation of the wall. Belongs to Group III.

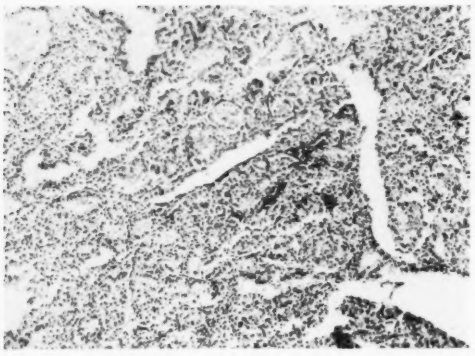

Fig. 8. Solid exophthalmic goiter of 4 years' duration. Administration of Lugol's solution for 16 days. In many of the smallest acini well stained colloid is found.

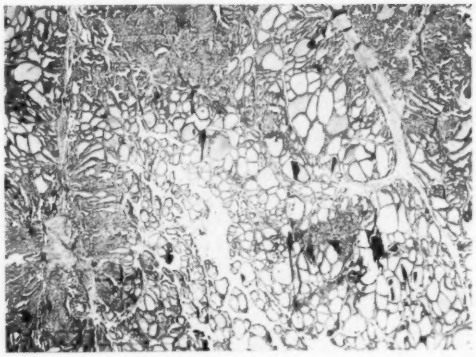

Fig. 9. Exophthalmic goiter removed on the fifteenth day of Plummer treatment. All kinds of transitional stages from the colloid to the exophthalmic goiter are seen, very much like that in Figure 5, except in this case the acini are filled with dense colloid.

the projections a closely packed mass of epithelial cells was seen with many capillaries. These solid cell groups could be traced to the epithelial lining by diverticula budding from the wall (Fig. 2). In these, which were at first solid masses, small acini form by separation of cell groups which in my judgment is the most common way of producing the formation of new follicles. It is the same process which Sanderson described in the normal adolescent gland and which is found often in the diffuse colloid goiter. By this new production of cells, secondary lobules are formed the peripheral cell masses of which are descendants of the epithelial wall of a large acinus. The lumina become more and more narrowed until a branching elongated duct results. These irregular duct-like forms of the acini in the exophthalmic goiter caused Klose, Zander, and others to hypothecate their origin from the central canaliculi of the embryonal thyroid gland. I believe, on the contrary, that these ducts are not the origin but the final product of the epithelial proliferation.

Group III. Exophthalmic goiter (Fig. 3). These were 8 glands in which the epithelium predominated and which on the first glance appeared as solid masses of cells. With higher magnification very small acini could be seen surrounding ramifying, long, narrow, ducts. These were regarded as rests of the former wide lumina of the colloid goiter. The acini appeared empty, or their content, faintly acidophilic, looked ragged and granular.

Group IV. Solid type of exophthalmic goiter (Fig. 4). The solid type of exophthalmic goiter was seen in seven of our cases. Clinically they did not, as in Rienhoff's opinion, represent acute, very severe cases of Graves' disease, but the toxic symptoms were of long standing. All made a good recovery after operation. In the only acute case in our series in which the outcome was fatal, the patient died without operation and belonged to the second group.

Generally Group IV is distinguished as solid or glandular—in contradistinction to the papillary type. We consider these solid glands the final stage in the development of exophthalmic goiter and not an entirely different type of goiter, because we find here and there in sections of solid exophthalmic goiter the same long duct-like acini we find in the other groups.

In one-third of the glands it was difficult to determine the exact stage of development because their microscopic picture was so varied. Different portions taken from the same gland and even different areas in the same microscopic section may show different stages of epithelial hyperplasia. In Figure 5, all kinds of transitional stages are present: the wide, round follicles of the quiescent colloid goiter, the irregular acini of the papillary form, and the solid tissue of the glandular exophthalmic goiter. The focal nature of the alterations in

the thyroid may be recognized in the fresh cut surface of the gland by the opacity and granular surface of the altered areas in contrast with surrounding colloid-rich tissue (21 per cent of our first series). It is difficult to understand why the lesion should appear thus in certain areas only, involving a great number of alveoli or only a few follicles. It is necessary, however, to keep these facts in mind in studying the pathological changes found after Plummer's treatment.

We made a study of the glands in 30 patients who had exophthalmic goiters and who had received Lugol's solution from 3 to 19 days before operation. The gross appearance of these glands requires a brief consideration. Rienhoff was struck by the vast difference between the thyroid glands in patients treated with iodine and in those in which iodine had not been given. In the former the gland seemed to him to be quite definitely increased in size and harder in consistency; the capsule was thickened and seemed to bulge with the contained lobulated parenchyma. On incision he found the gland in certain areas more resistant to the knife, the lobulation being more pronounced. The cut surface was glairy and showed small cyst-like areas suggesting beginning adenomata which were full of fluid resembling colloid. The glands of our second series did not show any striking difference in their gross appearance as compared with the glands in which iodine was not given. Seventeen per cent of them had a glairy, translucent, amber red cut surface, but this was noticed also in 16 per cent of the first series. In about the same percentage as for the glands taken from unprepared patients, namely in 83 per cent, the lugolized glands presented typical, gray, meaty parenchyma either uniform throughout the cut surface or only in numerous irregular patches. Cyst-like lumina were found in 74.8 per cent of the glands of patients receiving iodine and in 84.8 per cent of the glands of patients who did not receive iodine.

MICROSCOPIC FINDINGS

Rienhoff describes the acini as wide, ballooned, of regular form and size. We expected to find after Plummer's treatment only glands belonging to our Group I. But we had to classify our microscopic findings in the same four groups with about the same percentage as in our first series. Twelve cases of our second series belonged to Group I (Fig. 6), 3 to Group II, 7 cases represented the third (Fig. 7) and 8 the fourth type of our classification (Fig. 8). Considering the size of the follicles and the amount of solid parenchyma, we were not able to notice any striking difference between the two series. We believe that the size of the acini depends on the stage of development of the lesion, and we must not compare pictures of different developmental stages as apparently Rienhoff did (Fig. 9).

Rienhoff noticed in the glands removed after iodine treatment, the enormous increase in the fibrous connective tissue disseminated very irregularly throughout the gland. There was in his judgment a true sclerosis of the glands. With the exception of a single instance not any of the thirty glands showed such a sclerosis. There was no difference in the amount of connective tissue in the glands of the first series as compared with those of the second. It would be very difficult to understand how, in a few days, this fibrosis could develop. The only case in my series with septa larger than in the normal gland was one which had received several X-ray treatments which may have been the cause of the increased stroma.

The blood vessels and lymphatics were much less evident in Rienhoff's cases after Plummer's treatment, being collapsed by the pressure of the distended acini. Cattell, too, saw a decrease in vascularity, according to him caused by endarteritis. We are not able to corroborate any of these observations. With A. Kocher we believe that it is nearly impossible to estimate the vascularity of the living gland from the appearance of the microscopic sections. The amount of blood in the capillaries depends on the succession of ligation of the blood vessels. There will be congestion if the veins have been ligated previous to the arteries; anæmia if the arteries have been first ligated. It is likely that Rienhoff removed the sections for biopsy without ligation and made the resection of the gland after ligation of the thyroid arteries. The capillaries were in both of our series very well filled, and no difference could be noticed. I was unable to corroborate Cattell's description of endarteritis.

In Rienhoff's material, the lymphocytic infiltration was much less pronounced than in the cases in which Lugol's solution had not been given, and the areas that were present seemed to be markedly reduced in size. In our first series in which iodine was not given, we found 2 glands without, 5 with few, and 23 with many groups of lymphocytes. In the glands removed after Plummer's treatment we found 10 glands without, 7 with few, and 13 with abundant lymphocytic infiltration. This would mean a slight but distinct difference between the two series. By far the most pronounced change which Rienhoff observed after iodine medication was in the appearance of the colloid. It was abundant, distended the acini to their capacity, and stained uniformly throughout. In some glands Rienhoff saw large colloid cysts and localized areas of very much dilated acini encapsulated with compressed parenchyma indistinguishable from the so-called adenomata, which in his opinion developed during the Plummer treatment.

If we discard one case which received Lugol's solution for only 3 days, we found in 84 per cent of the glands removed after iodine medication a definite change in the amount and consistence of the colloid. Not only the large follicles, but also the small ones were filled with a refractive, evenly and deeply stained substance. Compared with sections of glands removed without iodine medication, this change of the colloid is so definite and so consistent that we feel justified in regarding it as the result of the iodine medication.

However, we must not overlook the fact that in 16 per cent this change was missing and this was true not in patients, as Giordano and Cattell believed, without clinical improvement but in patients who showed a definite remission of the toxic symptoms after administration of iodine. The problem is still more complicated by the fact that one gland had thick colloid but there was no clinical improvement.

In 20 per cent of the glands of our first series the colloid had a thick consistency although we are sure that the patients had not received any iodine in the hospital. Still we have the suspicion that these cases received iodine in some form before entering the clinic. One patient admitted that he had taken medicine at home, another was treated by an internist after the Plummer treatment was generally accepted by the profession. Two of those cases in which thick colloid was found throughout the gland died a short time after the operation, of an acute thyrotoxicosis. These patients were not regarded as bad operative risks and were prepared only by a short period of rest, 2 and 5 days respectively. We are wondering if these patients did not receive iodine before admission to the hospital and thus simulated a mild case on account of a regression of the toxic symptoms. Lahey called attention to the danger of giving iodine without the knowledge of the surgeon, thus making it impossible for him to recognize the severity of the disease.

In two patients in our first series who had received bromides for 12 days, well stained refractive colloid was present in the gland. This can be explained perhaps by Fellenberg's analysis of the officinal salts of bromide which contain a considerable amount of iodine.

Less evident and only secondary to the quality of the colloid were the changes of the epithelial cells after administration of iodine. The columnar form of epithelium prevailed in 42 per cent of the lugolized glands as compared to 59 per cent of the unprepared. Cuboidal cells were found in 55 per cent of the glands removed after Plummer's treatment and in 40 per cent of the controls. In 38 per cent of the glands of the second series, many high papillations were present as against 70 per cent in the first series.

Still less marked was the difference in the desquamation of the epithelial lining of the acini between the glands removed after, and those without, iodine treatment. Twenty-four of the lugolized glands showed pronounced desquamation as compared to 33.3 per cent in the first series.

Rienhoff on the contrary found the majority of acini lined with flat cuboidal cells, which seemed inactive and shrunken. The nuclei were pyknotic and no acini were filled with desquamated cells.

SUMMARY

Thirty exophthalmic goiters removed after Plummer's treatment were compared with

thirty glands removed without previous iodine medication. Most of the observations described by Rienhoff could not be confirmed. After Plummer's treatment no changes in the vascularity and in the amount of fibrous tissue were found. The acini were not round, smooth-walled and of regular size and form. Neither was the epithelium flat, cuboidal nor were the nuclei small, irregular and pyknotic. A formation of adenoma-like tumefactions and colloid cysts visible with the unaided eye did not occur in our material. In 84 per cent of our glands removed after Plummer's treatment, the only definite difference as compared to untreated cases was found in the appearance of the colloid. The acini of these glands had more and higher concentrated content in spite of the fact that the hyperplastic character of the glands was not altered.

These findings corroborate Albert Kocher's observation that most of the Basedow glands removed after iodine medication show distinctly more stained colloid than those without.

Therefore, if we regard the liquefaction of the colloid as the most characteristic feature of the exopthalmic goiter, we doubt that the change in the amount and quality of the colloid which follows Plummer's treatment explains the clinical improvement completely. The fact that, in our material, four cases improved very well on Lugol's solution but did not show thick colloid in the glands, and that one case did not improve on iodine but had a gland rich in concentrated colloid suggests that this problem is much more complicated and will not be solved by the anatomical method alone.

NEWER ASPECTS OF LIVER DISEASE[1]

By EDMUND ANDREWS, M.D., WILLIAM A. THOMAS, M.D., AND KARL SCHLEGEL, Chicago
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ABOUT a hundred million years ago, biologists tell us, cells began to succeed better in life's battles by joining together for the common purpose of finding and assimilating food. Since then there has developed a progressive specialization of the cells in multicellular organisms to an extent that is seldom realized. The interdependence of these cells has become such that none is able to live alone; in fact, one of the triumphs of modern science has been the artificial restoration of conditions approximating those of life close enough to permit such survival. This specialization has become so extreme that most cells have but one function: gland cells excrete, for the most part, specific substances, such as mucus, thyroxin; skin cells only make their contribution of keratin and die; others conduct nerve impulses. The whole life of the majority of our cells is of this type. They are mere machines which perform very limited functions and have to be fed and cared for as well as controlled by other less differentiated cells.

It is as such a mass of undifferentiated cells that we may look upon the liver. We used to hear a good deal about the function of the liver. Much searching for specific functions was done with but little result. A few years ago the word "glycogenesis" would have pretty well summed up our ideas on liver functions. Now we know that it is concerned in nearly all fundamental vital processes and its functions are manifold. We should then look on the liver from the opposite standpoint. It has no function necessarily to serve other cells. Other organs serve it. It is really the "liver" in a punning sense. It merely "lives" as an undifferentiated set of cells which have withstood the tendency to specialization and are concerned mainly with the most fundamental physiological process, the assimilation of nutrition.

With this biological conception in mind, let us turn to a matter which has been of supreme interest to modern biologists, and which makes up a large share of the general biological literature of the day. I refer to cell permeability

[1]Read before the Chicago Surgical Society, January 6 ,1928.

in relation to the mineral salt content. It has been demonstrated by a very large number of workers that the concentration of the ions of calcium as opposed to those of sodium and potassium has a very delicate balance which has to be maintained with great exactitude in order to support life. If the number of calcium ions in the media is increased, there will be a so-called "freezing" of the cell, and it becomes impermeable. It is no longer able to pass material in and out of its cell membrane; no food is absorbed, and it passes into a quiescent state. If the sodium or potassium ions are increased, the opposite takes place. Permeability is increased, activity of all sorts is hastened, and if the process is carried too far, cell dissolution takes place and it falls to pieces from too great permeability of its covering membranes.

Bearing these points in mind, we will now discuss the clinical aspects of liver disease as seen by surgeons. These may be classified under three headings: (1) parenchymatous degenerations, due to obstruction of the bile ducts; (2) similar changes of lesser degree following ether or chloroform anæsthesia; (3) hepatitis, inflammatory degenerations due to infection from the gall bladder or other foci in the portal circulation. In the same general category on the medical side are cirrhotic diseases, eclampsia, and anaphylactic shock. This entire group are marked by a peculiar train of symptoms, vague but none the less definite. The group is characterized by falling blood pressure, slowing of the pulse (except in the more acute cases), itching, disturbances of the acid base equilibrium, and albuminurias, generally of high degree. Much investigative work in this field has hitherto cast but little light on the mechanism of these diseases. Liver function tests by the dozen have been developed and tried, but they are of no avail to correlate the symptoms with the pathology.

The obvious point is, of course, that none of these things which happen in liver disease is a symptom of hepatic insufficiency. The elaborate experiments of Mann have shown us very clearly what happens when the liver is removed. The first and most important result of hepatectomy is hypoglycæmia. This is profound, progressive, and rapidly fatal, unless it is counteracted by glucose injections. Urea formation ceases, uric acid is increased, but not to toxic levels as it is rapidly excreted. The amino acids in the blood are increased but also not to toxic levels. These are the only changes of any possible significance noted in such animals, but nevertheless the animals all die in a few hours and the cause of death is utterly unknown. However, it is certainly not anything like what we miscall hepatic insufficiency in the clinic.

For a long time it has been supposed that in jaundice and other liver diseases the toxic agents were the bile salts, salts of taurocholic and glycocholic acid. To them was attributed the itching renal irritation and albuminuria, falling blood pressure, etc. Recently, Rowntree and Greene have made a brilliant series of studies on this subject which appear to be conclusive, and to prove that there is no relation between the concentration of bile salts in the blood and the symptoms of jaundice and hepatitis. Increased bleeding time, itching, and jaundice, are all shown to occur both with normal and with increased bile salt concentration, and the injection of the salts into animals far beyond any amounts met clinically fail to produce these symptoms.

Amino acids as a cause of toxæmias have been studied by Neuman and Marsh with the result that they too can be ruled out completely as a cause of toxic phenomena. Amounts varying from two to four grams per kilo were injected and in none of them, except histidine, was any toxic effect evident. These amounts are overwhelming compared with any concentrations ever met with clinically and show beyond a doubt that they are not the offending agents. It has long been known that the bile pigments themselves are not toxic aside from the obvious evidence that profound liver shock may occur in the absence of jaundice. In addition there is the interesting phenomenon which we have often noted that if the common bile duct of a dog is ligated, his jaundice increases for only a week or so, and later, almost entirely clears up in spite of the fact that he becomes progressively sicker and finally dies.

Polypeptids in the blood have been recently studied by Jackson, Sherwood, and Moore,

and they have proved that these substances do not occur in amounts large enough to be toxic.

The evidence, then, is so far entirely negative. We can say with assurance that the cause of the symptoms of jaundice, etc. is not bile salts, bile pigments, not glycogen starvation, not polypeptids, not amino acids. There is not much left. Still these symptoms do occur, and they must be due to some toxin arising in the liver as they are absent after hepatectomy.

Our first lead along this line arose from the work of Mason. He recently published the fact that if small amounts of liver were cut off and dropped back into the dog's abdomen, a rapidly fatal toxæmia ensued. A few grams were sufficient to cause death within 18 to 24 hours. In his animals the toxæmia was marked by a fall in the concentration of the serum and plasma, increased coagulation time, increased fibrin in the blood, and increased uric acid.

These experiments have been criticized on the assumption that this procedure killed the dogs by producing a peritonitis, but we have repeated them, inserting the bits of liver into the chest and into the axilla and have had the same results. Mason thought that the toxic fraction was in the non-protein nitrogen fraction but the results are not positive.

It is obvious, therefore, that there is a substance in the liver which can cause severe toxæmias, and with this in view we undertook a study of the liver proteins as they seemed to be the only substances not yet accounted for. In the first place in some experiments already reported by Peterson and Andrews, it was shown that in totally eviscerated animals, injection of large amounts of bacillus coli toxin which ordinarily causes a heavy albuminuria had no such results in the absence of the liver. Shock, chills, and fever, ordinarily provoked by such injections were conspicuous by their absence. This finding seemed additional evidence that some liver protein was at fault.

EXPERIMENTAL

The proteins in the urine of dogs with hepatic disease were studied immunologically by the following method. The common bile ducts were tied and the urine collected twice daily, in the studies on obstructive jaundice. In those on ether toxæmias, female dogs were catheterized, deeply intoxicated with ether for 2 to 3 hours, and samples of urine taken every few minutes. In each case the earliest samples showing albumin were saved and the proteins studied.

Antisera were prepared against dog blood by the method previously described by us which would react to dog blood in dilutions of 1:1,000,000. Next, dog livers were perfused until the perfusate was protein free, ground, and extracted and antisera prepared which were sensitive to 1:100,000 against dog liver. Of course, the liver antiserum was also highly potent for blood, as it is impossible to wash all the blood out of the liver. In both the jaundiced and etherized animals, the early specimens of urinary protein gave reactions in high dilutions to liver antiserum and none to blood antiserum. This may be regarded as proof positive that this urinary protein originated in the liver. In later specimens, there also followed the excretion of large amounts of blood protein.

Next, studies of the mineral salt content of normal and pathological livers were undertaken. These results are being published *in extenso* elsewhere, but we may say here that in dogs in which the common bile ducts have been ligated and severed, there is a profound fall in the calcium in the liver. Normal dog livers analyzed in our laboratory have a calcium content very close to 2.2 milligrams per gram of dried substance. In jaundiced animals it falls to 180 to 170 milligrams. This represents a change which *per se*, without assuming any toxæmia, is sufficient to bring about a disintegration of cells and a leakage of the normal cell contents into the circulation. While there is but slight variation in the potassium contents of such livers, the increase of the sodium ion is enormous and amply accounts for the cell dissolution which microscopic studies show to take place.

DISCUSSION

It is well known that proteins that are foreign to the blood are promptly excreted by

the kidney. This has been shown to be true for egg albumen and serum proteins of other species. In our laboratory, it was demonstrated by MacDonald in experiments bearing much more closely on this problem. He injected a mixture of dog blood and liver proteins into dogs and found that the blood protein was held back and the liver proteins were excreted in large amounts.

What then is the mechanism of this albuminuria? It is clear that for some reason as we have shown, protein passes from the liver and makes its way into the blood where it is excreted as foreign protein. Why does it leave the liver? It is in all probability bound up with changes in the permeability of the liver cells due to a disturbance in the mineral salt balance, which I discussed earlier in this paper.

In a recent communication, one of us suggested that in uræmia such a mechanism was acting. The recent use of overwhelming doses of calcium, as employed by Walters and others, in the treatment of jaundice is a striking confirmation of this theory, especially as the clinical results have been found to be so excellent.

CONCLUSION

1. A protein from the liver is passed in the urine in the early stages of certain hepatic diseases.

2. This leakage of protein from the liver is due to a disturbance of the mineral salt balance.

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CANCER OF THE CERVIX UTERI

Its Surgical Treatment and Criteria Essential to the Establishment of a Prognosis Following Operation[1]

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FROM a review of the literature of the past few years, one might well conclude that surgery, in so far as it has been applied to cancer of the cervix uteri, is wellnigh *passé*. The almost hysterical rush of many of our foremost American and European colleagues to forsake surgery for the charms of radiotherapeutic measures is sufficient to arouse more than passing interest. Indeed, the stampede to radiotherapy immediately warns us that all is not well with surgery as it concerns cancer of the cervix uteri.

One notes with concern the formation of well defined groups of protagonists: those favoring surgery only in apparently operable cases of cancer of the cervix uteri; those favoring radium and deep X-ray therapy as the only remedial procedure in all cases; and happily a third group who realize that there probably is virtue in both procedures and are trying to solve the problem in a quiet, deliberate, and unbiased manner. It is from the latter group that we will ultimately obtain information of permanent and constructive value. Such observations require a period of 8 to 10 years in clinics where the work is carried on by a small group of competent individuals according to a well formulated plan, which should include the collaboration of one versed in pathology so that tissue correctly obtained as well as properly fixed, cut, and stained, may be studied and filed away for future reference.

Argumentation and partisanship rarely lead to correct scientific deduction; indeed, they tend to obscure one's vision and defeat the purpose of investigation, which is merely the ascertaining of facts whatever they may be. The purpose of this paper, therefore, is not to present surgery as applied to cancer of the cervix uteri in a light which may appear to belittle other therapeutic agents; rather we propose to analyze critically some phases of cervical cancer treated by surgery in order that we may more fully appreciate its advantages as well as its limitations and the cause therefor. In a similar way we may also obtain a more accurate method of comparing results in patients treated with radium and X-rays.

A consideration of surgery as properly applied to cancer of the cervix uteri involves two factors: first, a proper selection of patients for operation; and, second, an adequately performed operation by one experienced in this type of surgery.

SELECTION OF PATIENTS FOR OPERATION

What constitutes the borderline between operable and inoperable cancer of the cervix uteri is in a large measure a matter of individual interpretation. A study of the material from 290 patients who were operated upon at the Johns Hopkins Hospital prior to the year 1920, as well as studies in other clinics, has yielded some definite criteria to govern us in deciding clinically whether or not a given patient comes within the scope of operability. By operability is meant that the condition is such that, on the basis of experience, a permanent cure may reasonably be expected.

Extension of the cancer to the rectum, bladder, or paracervical tissues, in our experience and the experience of numerous others, precludes the possibility of a permanent cure. If the cancer extends on to the vaginal wall to a point which makes it impossible to remove the growth and still leave a macroscopically normal margin of at least 2 centimeters, local recurrence will almost inevitably follow. Regional lymph-gland involvement and ureteral obstruction originating in the cervical parametrium, in our experience, likewise prevent permanent cure by operation. Occasionally a patient with the first complication may live as long as 8 to 10 years before recurrence proves fatal.

Another factor of importance in helping us

[1] Presented before the Vancouver Medical Association, Vancouver, B. C., December 6, 1927.

to determine whether a patient should be operated upon is the length of time she has had the neoplastic disease. The history of the duration of the symptoms of bleeding or abnormal vaginal discharge will help to determine this point, although obviously such a determination is crude and inaccurate. However, from the experience gained at the Johns Hopkins Hospital, it would seem that, in the epidermoid variety of cancer, a history of symptoms of more than 8 months' duration, is in itself generally sufficient to put the patient beyond the hope of cure from operation no matter what the pre-operative clinical findings have been. Unquestionably, there will occasionally be an exception, but it will probably be safer to accept this rather than most clinical generalizations.

It is essential to determine clinically before operation whether all of the foregoing contraindications to surgical intervention exist. It is possible by bimanual vaginal and rectal examinations, vaginal, rectal, and bladder visualization as well as pyelography to determine all of the foregoing factors except two, namely: regional lymph gland and parametrial extension of the disease. It should be stated, too, that if the neoplasm has not actually involved the bladder mucosa, it is difficult to interpret accurately the bladder findings by means of the cystoscope.

If by any chance the patient is so emaciated that the exploring finger in the pelvis detects palpable and adherent iliac or obturator glands, then the local process is so well advanced that it is manifestly not wise to operate. Generally gland involvement cannot be determined before operation.

The clinical determination of involvement of the cervical parametrium, however, presents a most important and as yet rather insurmountable obstacle to the accurate clinical appraisal of the neoplastic dissemination. If the uterus is fixed and the vaginal vault and cardinal ligaments are densely hard, the inference of paracervical infiltration, in most cases, is obviously correct. However, if the uterus presents questionable, if any fixation, slight induration of one or both lateral vaginal fornices, and moderate or slight, but nevertheless definite, paracervical induration, what then is the correct interpretation? The answer is difficult and not forthcoming.

In the material at the Johns Hopkins Hospital, paracervical induration was noted 107 times in 290 patients operated upon, an incidence of 36.8 per cent. In 63 of these patients, 58.8 per cent of 107, the broad ligament induration signified carcinomatous extension; in 31, 28.8 per cent, it did not signify cancer, and in 13, 12.1 per cent, the finding occurred where the histological extension was debatable.

On the other hand, among 92 patients with histological extension of cancer to the paracervical tissue *in whom broad ligament induration was sought for* 63, 68.4 per cent, revealed induration while 29, 31.5 per cent, did not. In brief, about one-third of the patients with broad ligament extension of the cancer gave no demonstrable clinical evidence of it, while about two-thirds did. Again of the 107 patients operated upon who had clinical broad ligament induration, not quite two-thirds showed paracervical histological invasion of the cancer.

From these figures the rough generalization is then possibly permissible that broad ligament induration signifies paracervical carcinomatous extension in about two-thirds of the patients who otherwise are considered good operable risks.

TECHNIQUE

The second factor of importance in the application of surgery to cancer of the cervix uteri is an adequately performed operation.

There is general agreement among gynecologists that an adequate operation for cancer of the cervix uteri involves *nothing less than* a panhysterectomy, with removal of the proximal one-third to one-half of the vagina and a wide parametrial dissection which is possible only after the ureters have been demonstrated and mobilized for their distal 10 centimeters or more. Considerable difference of opinion exists as to regional gland extirpation. As a result three groups of operators exist, each using one of the following procedures:

1. *Routine extirpation of iliac and obturator glands.* This is the procedure originally advocated by Ries, in 1895. At the present time

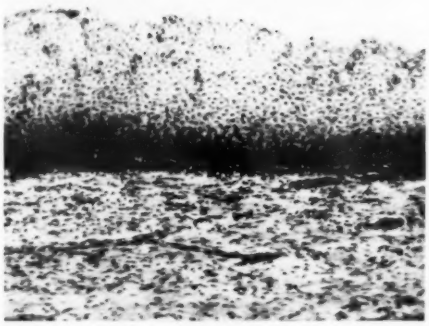

Fig. 1. Normal cervical epithelium.

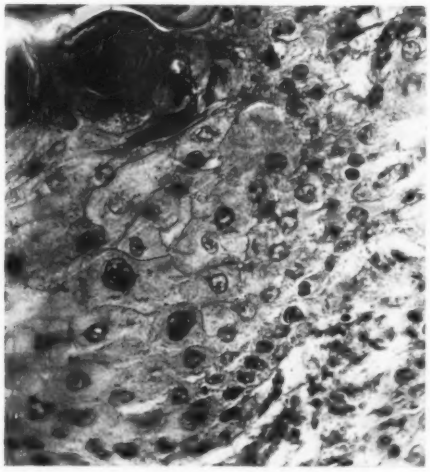

Fig. 2. Spinal cell cancer with an epithelial pearl.

Victor Bonney, of London, is the active exponent of this procedure. In the United States, C. Jeff Miller and Howard C. Taylor[1] if they operate utilize this procedure which was also used by Bumm, Doederlein, and Zweifel in Germany.

2. *Extirpation of regional lymph glands only when palpably enlarged.* This is the procedure advocated by the late Ernst Wertheim, his pupil, Weibel, and many others. In the United States, Graves,[1] Spalding[1] and Cobb advocate a similar procedure.

3. *Non-removal of regional lymph glands.* Most gynecologists who now operate for cancer in this location follow this method. Cullen is its outstanding exponent. He operates in all operable cases. Among others who do likewise, may be mentioned Peterson, of Michigan; Davis, of Harvard; and Hartmann, of Paris.

It is difficult to find a rational explanation for *three* such divergent points of view and practices. There is, however, excellent reason for two of the methods, namely, the first and third.

Regarding the routine extirpation of regional pelvic lymph glands, the altogether logical explanation is that this is the correct operative procedure in all cases of cancer in which the regional lymph nodes are accessible. Against this practice may be noted (1) the increased primary operative mortality; (2) the involvement of inaccessible lateral aortic glands in certain cases in which lymph node metastases exist; (3) the comparative inability to effect permanent cures in patients with lymph gland metastases. The experience at the Johns Hopkins Hospital reveals that none of the patients with lymph gland metastases was permanently cured. However, 7 per cent of those with lymph gland metastases (as shown by microscopic examination of extirpated glands) were free of recurrence at the end of 5 years. The experiences of Weibel (16), Wertheim (17), and Rosthorn (reported by Schottlaender and Kermauner, 14) are virtually the same. Weibel does not believe that removal of cancerous lymph glands produces any important increase in the 5 year cures.

On the basis of the foregoing, we feel that the operation fulfilling the minimal operative requirements previously given with non-removal of the regional lymph glands has a rational basis for the surgical treatment of this disease.

There is probably not much to recommend the procedure of extirpating only enlarged lymph glands, for these may be merely inflammatory hyperplasias, while glands which are scarcely palpable may be completely occupied by carcinomatous metastases.

[1] These surgeons operate only on very early cases of cervical cancer.

TABLE I. PERICERVICAL INDURATION AND ITS SIGNIFICANCE

	Cases
Patients operated upon	290
Number having induration (36.8% of 290)	107
Induration indicated cancer extension in (58.8% of 107)	63
Induration indicated no cancer extension in (28.9% of 107)	31
Induration indicated questionable extension in (12.1% of 107)	13

TABLE II. PERICERVICAL EXTENSION OF THE CANCER AND THE INCIDENCE OF PERICERVICAL INDURATION ACCOMPANYING IT

	Cases
Patients having histological extension of cancer	92
Patients presenting clinical pericervical induration (68.4%)	63
Patients presenting no clinical pericervical induration (31.5%)	29

A recent report (1926) by Victor Bonney (4), of London, is decidedly at variance with the experience at Johns Hopkins and other clinics, and it challenges attention. Bonney practices routine extirpation of the iliac and obturator lymph nodes. Among 130 patients who were operated upon 10 or more years ago, 50 showed lymph gland metastases. Of these 11 (22 per cent of 50) are free of recurrence, and on the basis of this Bonney continues lymph gland extirpation.

Anæsthesia. With a primary mortality varying from 4 to 20 per cent in this operation every phase of the operative technique has received close scrutiny.

Surgical anæsthesia is an integral part of the operative technique for cancer, and it probably is not an exaggeration to say that in the last decade and a half, greater advancements have been made in the refinements of anæsthesia than have been made in the *fundamentals* of surgical technique as employed in the foremost clinics. Particularly in America, the cradle of ether anæsthesia, has advancement been made in the technique of inhalation narcosis. The correct employment of ethylene-carbon dioxide-oxygen mixture with minimal amounts of ether is destined, I am certain, to lower materially the primary mortality in radical operations for cancer of the cervix uteri.

Ethylene anæsthesia permits perfect relaxation. At the end of a difficult, 2½ hour operation, not complicated by excessive hæmorrhage, the patient is in excellent condition—a fact which cannot be appreciated by any but those who have actually experienced the situation. Instead of the customary, pale, clammily moist, profoundly narcotized woman with tachycardia and marked vascular hypotension, one sees a warm, pink patient with only slight acceleration of pulse, and a blood pressure little altered from what it was prior to operation. By the time she has been returned to bed, she is conscious and in an hour to two can easily engage in intelligible conversation.

In England and on the Continent where inhalation narcosis in most clinics is produced with chloroform and chloroform-ether mixtures, the operators have sought refuge in the injection of anæsthetic solutions, particularly in spinal anæsthesia. This procedure in expert hands according to Doederlein produces a mortality of less than 0.1 per cent. Its employment is considered by Bonney to be a large factor in his decreased operative mortality of 12 per cent. Suessmann (15) has reduced his initial mortality to 3.5 per cent in 168 patients on whom radical operations were done and spinal anæsthesia was used, while Weibel (16) reports a 4.2 per cent mortality in 48 personal cases operated upon.

Operative mortality. Without going into tedious detail, a word may be said about operative mortality as it concerns the radical operation. Table III is self-explanatory and reveals the present distribution of mortality in different clinics.

When one considers that, in some clinics, operative shock is one of the most frequent single causes of death at operation, it is apparent that the previously noted improvements in anæsthesia are necessary and should reflect a definite reduction in the operative mortality due to shock.

In the Johns Hopkins Hospital up to 1919, 22 per cent of the operative deaths were due to surgical shock. From 1920 to 1926 inclusive only one operative death due to shock occurred. It is safe to say that the administration of anæsthesia by trained anæsthetists has been an important factor not only in this improvement, but also in lessening other post-

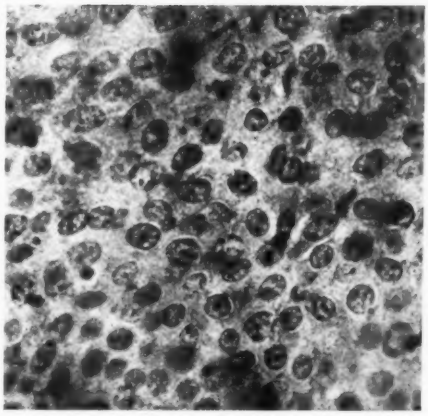

Fig. 3. Transitional cell cancer.

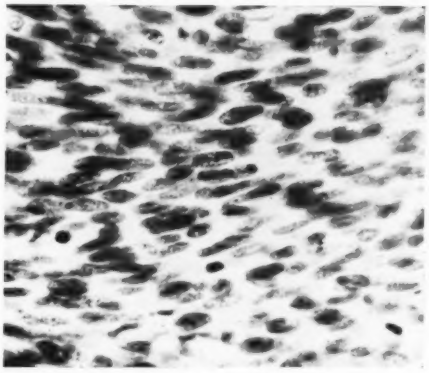

Fig. 4. Spindle cell cancer.

operative complications, such as abdominal distention (6).

CRITERIA FOR PROGNOSIS

Two types of prognoses are often desired by patients and more particularly by the immediate family, viz.: (1) the outlook as to the patient's ability to withstand the immediate operative procedure; and (2) the possibility of an ultimate cure, provided, the patient survives operation.

The first query can be immediately answered. In correctly selected patients who are properly prepared for operation, an operative mortality of not over 5 to 6 per cent should be anticipated. In comparatively early cases in which the disease is limited to the cervix, a mortality not over 1 to 2 per cent should occur. This may appear at variance with some of the figures in Table III. However, in numerous instances these figures represent operations performed on patients who presented local processes technically most questionably operable while the patients themselves were poor operative risks.

The second request, to look into the future, cannot be met until the operation is over and the pathological specimen is subjected to adequate microscopic examination. An adequate examination entails the study of numerous celloidon or paraffin microsections obtained from blocks representing all the cervical parametrium, which is cut at right angles to the longitudinal axis of the cervix, the entire length, and anteroposterior thickness of the vaginal cuff, cervix, and the corpus uteri to a point well beyond its macroscopic involvement. The adnexa should also be sectioned.

A study of this tissue should determine the extent of the local, neoplastic invasion, the variety of cancer (whether adenocarcinoma or epidermoid carcinoma), and, if an epidermoid cancer, the predominant type of cancer cell. With these data available a prognosis can be given as to the anticipation of an ultimate cure with a reasonable degree of accuracy. To lend meaning to such data it has been necessary to make a critical analysis of many pathological specimens and finally to

TABLE III. SHOWING THE TREND OF PRIMARY OPERATIVE MORTALITY FOLLOWING OPERATION FOR CARCINOMA OF THE CERVIX UTERI

	Per cent
Cullen, of Johns Hopkins	6 to 9.0
†Spalding, of Stanford	11.5
*†Miller, of Tulane	7.0
Lynch, of California	6.6
†Graves, of Harvard	4.5
Davis, of Harvard	9.3
†Clark, of Pennsylvania	6.0
Peterson, of Michigan	26.6
*Bonney	12.0
Wertheim	8.0
*†Doederlein	20.7
*Suessmann	3.5
*Zweifel	4.9
Weibel	4.2

*Practice routine removal of regional lymph glands when operating.

†Use radium practically exclusively.

TABLE IV. PERCENTAGE INCIDENCE OF "FIVE YEAR CURES" FOR THE DIFFERENT TYPES OF EPIDERMOID CANCER OF THE CERVIX UTERI

	Johns Hopkins Hospital (Martzloff) Per cent	Mayo Clinic (Broders personal communication) Per cent
Spinal cell cancer—		
Grade 2 of Broders.....	47.00	53.33
Transitional cell cancer—		
Grade 3 of Broders.....	24.2	21.5
Fat spindle cell cancer—		
Grade 4 of Broders.....	9.5	9.52

Operative Prognosis—Cancer of Cervix (Martzloff) J. H. H. Bull. March, 1927

correlate the findings with carefully obtained and preserved case records.

On the basis of such a study (7, 8) it has been shown that cancer of the cervix uteri varies greatly in its malignancy. To recapitulate briefly, a study of the pathological material from 387 cases of cancer of the cervix uteri, at the Johns Hopkins Hospital, revealed that aside from the adenocarcinomata, the epidermoid cancers could be divided into three large groups, each being designated according to the type of cancer cell predominating. There were, necessarily, various combinations of cell types encountered, but it was found that the predominant variety of cancer cell indicated the relative malignancy of the individual process.

As a working classification, then, we have (1) spinal cell cancer; (2) transitional cell cancer; and (3) spindle cell cancer.

To illustrate this distinct variation in malignancy of cancer of the cervix uteri, the relative frequency of so-called "5-year cures" (as given in our first paper, occurring in each of the types of cancer as grouped above) is given in Table IV wherein are also compared the results obtained at the Mayo Clinic as reported by Broders.[1]

The results as shown in Table IV are so closely comparable as to stimulate skeptical speculation. However, it is worthy of consideration that the work in Rochester and in Baltimore was carried on independently and without knowledge on the part of either investigator that such work was in progress elsewhere.

[1] Personal communication.

This of itself practically refutes Plaut's (9) statement and inferences that it is impossible to have pathologists agree on a few characteristic cell types in carcinoma of the cervix uteri. As was shown in our first paper (7), numerous combinations of cell types occurred in our study, so many in fact that for the sake of clearness some were not enumerated. However, in practically all instances where a sufficient number of well cut and stained celloidon or paraffin sections were studied, it was possible to determine the predominant type of cancer cell. Naturally, in some specimens it was impossible to be certain which was the predominant cell, and particularly intriguing were those cases in which one could not satisfactorily decide whether certain predominant cells should be classified as spinal or transitional. Any confusion that arose was practically confined to these two groups, for it is readily seen that when, for example, a well defined cell membrane is not visible about a cell that would otherwise conform to our description of spinal cell we would then be forced either to establish another group (which was done at first in that way segregating all these doubtful cases), or to include them in the spinal or transitional cell groups. The latter course was adopted when the material from our study was grouped and classified. To one experienced in this type of work, it is at once obvious that the transitional cell classification would become the large dumping ground for doubtful cell types, for it is the transitional cell group that takes in all the variegated forms that do not conform to the spinal or spindle cell description.

It is also quite obvious to pathologists that the classification or description of all the numerous cell forms seen in cancer would be an endless, if not an impossible, and useless task. For this reason we had to confine our study to the predominating cell types in order to see what such an investigation might offer. This is shown in Table IV.

While Plaut attempts to compare his results with ours, he does not stress the important fact that his cases have all been treated by radiation while ours were treated by radical operation, a fundamental difference. On the other hand Pemberton (10),

studying a small series of cases operated upon, also finds a distinctly more favorable outcome in the spinal cell cancers. Schottlaender and Kermauner (14), studying Rosthorn's operative material conclude (p. 689) that among the epidermoid cancers the *unripe* variety, corresponding to our transitional and spindle cell types, show a greater degree of invasiveness. This we have also shown.

Concerning the use of radium, Schmitz (13), Cordua (5), and Pomeroy and Strauss (13) obtain their best results in the differentiated or more mature type of cancers (corresponding to our spinal cell type) while Boehm and Zweifel (3) obtain their most favorable results in the immature type of cancers (corresponding to our transitional and spindle cell types). In other words, the results from the use of radium in so far as cell type is concerned are conflicting, although the authors agree that there is a difference in the manner in which the various types react to radium. The latter point is well developed by Alter (1) in his careful histological studies of cervical cancer treated by radiation. The question naturally arises as to whether or not certain fairly definite criteria can be established which will make it possible, with such recent distinct advance in our knowledge concerning the variations in malignancy of this type of cancer, to forecast with a reasonable degree of certainty the prospect for cure following operation for cancer of the cervix. Obviously any method designed to establish prognostic criteria possesses inherent limitations that, with our present knowledge, are insurmountable, and we fully realize that any scheme for prognosis when applied to an individual case may prove untenable.

We have studied only patients suffering from unmistakable carcinoma of the cervix uteri on whom panhysterectomies were performed that fulfilled the minimal operative requirements previously noted.

This analysis (9) concerns 145 patients in the Gynecological Service of the Johns Hopkins Hospital, who were operated upon during the 27 year period between 1893 and 1920, and they fulfill the following criteria: (1) they were all operated on; (2) they all survived the operation and left the hospital alive; (3) their present status is known except in the case of some who have been lost after being traced 5 years.

We believe that the necessity for such a selection of cases is apparent, when one reflects that we are trying to ascertain what importance, if any, various factors possess for determining the ultimate outcome following operation in a given group of carcinomata. For the present, then, we are not concerned with operative mortality but with the problem of whether or not criteria can be established that will enable us within reasonable limitations to forecast what the outcome may be in a patient who has survived the hazard of an operation.

To appreciate better the possible influence of the various factors that may possibly play a part in the determination of a prognosis, each group of cancers was studied separately.

SPINAL CELL CANCER

In the spinal cell group we have included all of the cases in which the spinal cell type of cell is predominant irrespective of its combination with cells of other morphology. The cells characterizing this variety of cancer are morphologically similar to cells seen in the superficial zone of the stratum mucosum of normal stratified cervical epithelium (Fig. 1). The cancer cells are usually polyhedral in shape with well defined cell outlines. The nuclei, many of which possess nucleoli, take only a moderately intense hæmatoxylin stain and are separated from each other by an abundant quantity of surrounding cytoplasm which is only lightly stained by eosin (Fig. 2).

In this group are included 30 patients, and of 28 the present status is known. The two exceptions are, one patient who was followed for 6 years after operation and the other for 10 months, after which they could not be traced.

In Table V are tabulated the cases of spinal cell cancer, the salient data only being recorded. In this table as well as the subsequent tables of this type the data on the extent of cervical involvement have been omitted to lessen their size.

All patients in this group not otherwise recorded are dead, death with two exceptions

TABLE V.—SPINAL CELL CANCER

	Duration of symptoms in months									
	2	3	4	5	6	7	8	10	12	18
Number of patients	4	2	7	3	2	5	2	2	3	0
Extension of metastases										
Iliac glands	0	1	0	0	0	0	0	0	1	0
Fallopian tubes	0	0	0	0	0	1	0	0	0	0
Uterus	0	1	3	0	0	3	1	0	0	0
Bladder	0	0	0	0	0	1	0	0	0	0
Pericervical tissues	0	1	1	0	0	3	0	0	1	0
Moderate vaginal involvement	1	2	2	3	1	3	1	1	2	0
Marked vaginal involvement	2	0	3	0	0	1	1	0	0	0
Type of operation										
Combined	0	0	0	0	1	0	0	0	0	0
Vaginal panhysterectomy	0	1	1	0	0	0	1	0	1	0
Abdominal panhysterectomy	4	1	6	3	1	5	1	2	2	0
Dilatation and curettage several days prior to major operation	1	2	1	2	1	1	1	1	0	0
Living and well										
Number	3	0	4	2	1	3	1	0	0	0
Per cent	75	–	57	66.6	50	60	50	—	—	—
Dead or lost, but living or traced 5 years or more after operation										
Lost or death not due to cancer	—	–	—	—	—	—	—	—	1	—
Recurrence	—	–	—	—	—	—	—	—	*1	—

*8 years after operation.

being due to the sequelæ of cancer and occurring not later than 2 years after operation.

In studying Table V one is immediately impressed by two outstanding figures: first, the regrettably small number of cases and, second, the occurrence of "cured" patients. If one were to plot a curve of the "cures" in relation to the duration of symptoms before operation, one might conclude that it is just as well to operate late in the disease in spinal cell cancer as to intervene during its incipiency. Such a deduction would not be justifiable, but nevertheless one cannot but be impressed by the high incidence of patients who are living and well in the group in which the symptoms were of a duration of 1 to 8 months.

Metastases. None of the patients in this group with demonstrable metastases have remained well, all dying of recurrence, although one patient with symptoms of 12 months' duration and metastases to the iliac glands lived 8 years before succumbing to a recurrence.

Extension into the pericervical tissues. All patients with definite extension of the neoplasm into the pericervical tissue, and we include one extension to the bladder and rectum, have died of recurrent cancer, but if the extension was questionable as occurred in two instances the patients are still in good health. Four (13.3 per cent) of these patients showed histological evidence of cancer extending beyond the radial confines of the cervix.

Extension to the uterus occurred in eight instances (24.2 per cent) and in three of these (37.5 per cent of 8), the patients are well, so that in this group of cancers, invasion of the corpus uteri is not incompatible with operative cure. However, a more critical analysis of this particular phase is even more relevant and shows that an operative cure of 60 per cent occurred in those in whom extension to the uterus was uncomplicated by pericervical extension of the disease.

It would appear, therefore, that in carcinomatous extension from cancer of the cervix, that which is confined to the uterus is of least serious import. On the other hand, escape of the uterus apparently improves the postoperative prognosis, for, of the 14 patients who are cured, in 11 (78.8 per cent) there was no extension to the uterus.

Vaginal involvement. In case the vaginal involvement is not so extensive as to be beyond operative removal, it appears that even a marked degree of it does not materially damage the prognosis, for, of the 7 patients with extensive vaginal involvement, 4 (57 per cent) are living and well. Of the 16 patients with only moderate vaginal involvement, in 3, other extensions made operative cure impossible. Of the remaining 13, 7 (54 per cent) are well.

Extent of cervical involvement. In this group of spinal cell cancers, no definite relation can be shown between the extent of cervical involvement and the incidence of ultimate cures. Such findings hardly appear logical especially if the entire thickness is involved, for it would seem reasonable to assume that

the greater the involvement in thickness, the more likely is pericervical dissemination to occur.

In Table VI we have tabulated the extent of cervical thickness involvement in the patients who had spinal cell cancer but who are now in good health. The results appear to emphasize the apparent unimportance of the extent of cervical involvement, provided no pericervical dissemination occurs.

Type of operation performed. Radical panhysterectomy through the abdominal cavity was the operation performed on 25 (83.3 per cent) of these patients. Vaginal panhysterectomy was performed on 4 (13.3 per cent) and a combined vaginal and abdominal operation on one (3.3 per cent).

Of the patients who had the abdominal operations performed 12 (48 per cent) are living and well. One (25 per cent) of the four who had a vaginal panhysterectomy performed is living, while the only patient in this group who had a combined operation is now in good health.

Duration of symptoms. What part the duration of symptoms plays in our scheme of attempting to foretell the ultimate outcome in a given group of cases is probably difficult to estimate in the spinal cell group of cancers. We are arbitrarily selecting the eighth month of symptoms as the point beyond which a cure cannot be reasonably expected. However, in only 5 patients in this group were the symptoms of more than 8 months' duration, and 2 of these 5 had none of the extensions that would ordinarily constrain us to consider them inoperable. It is then obvious that were there more patients in this group of cancers, our data might be different. Fully appreciating the shortcomings involved, we have, on the basis of our data, taken a symptom duration of 8 months as the time limit beyond which an operative cure for spinal cell cancer may not be anticipated.

Diagnostic curettage. For years it has been a routine procedure at the Johns Hopkins Hospital, to obtain tissue for microscopic examination before the radical operation is performed. The custom now is to examine frozen sections before we proceed with the extirpation. It happens occasionally that in some

TABLE VI. SHOWING INVOLVEMENT OF CERVIX AT DIFFERENT PERIODS OF DISEASE IN PATIENTS WHO HAD SPINAL CELL CANCERS AND ARE NOW LIVING AND WELL

Duration of symptoms—months	Thickness of cervix involved		
	One-third Cases	Two-thirds Cases	Whole Cases
2	1	0	2
4	1	2	1
5	0	0	2
6	0	1	0
7	0	1	2
8	0	0	1
Total	2 (14%)	4 (28.5%)	8 (57%)

TABLE VII. CURED PATIENTS IN SPINAL CELL GROUP

	Number	Per cent
Five-year cures in patients not necessarily operable	16	53.3
Permanent cures	14	46.6
Operable patients in this group	22	
Permanent cures in operable group—14 in 22		63.6

early cases the freezing method is not adequate for the preparation of sections sufficiently thin to permit of a microscopic diagnosis. In such instances the patient is put back to bed and nothing further is done until rapidly prepared celloidin or paraffin sections are available for examination. The importance of obtaining tissue for examination prior to the radical operation cannot be sufficiently stressed, for it has proved of value in two ways, preventing, on the one hand, a serious operation where no cancer exists, and, on the other, occasionally revealing cancer where none was suspected (Cullen).

Diagnostic curettage several days prior to the radical operation was performed on 10 (33 per cent) of these patients. Three of these may be classified as cured so that of the 14 "cured" patients, we did a preliminary curettage on 3 (21.4 per cent).

Cured patients. Five-year cures, so called, are therefore seen to have been effected in 16 patients (53.3 per cent of 30) in the spinal cell group, and permanent cures in 46.6 per cent. However, in analyzing Table II more carefully it will be noted that of the 30 patients forming this group, in 4 there was a definite pericervical extension. One not included in the four just mentioned had iliac gland metastases, and three others, not included, were beyond the eighth month of

TABLE VIII.—TRANSITIONAL CELL CANCER

	Duration of symptoms in months												
	1	2	3	4*	5	6	7	8	9	10	12	18	24
Number of patients	10	6	16	14	7	11	4	1	8	3	5	2	3
Extension of metastases													
Iliac glands	0	0	1	0	0	1	0	0	1	1	0	0	0
Fallopian tubes	0	0	1	1	0	0	0	0	0	0	0	0	0
Uterus	0	2	2	0	1	1	2	0	2	2	2	1	2
Bladder	0	0	0	0	0	0	0	0	1	0	0	0	0
Pericervical tissues	1	2	7	4	2	4	2	0	6	2	4	1	2
Moderate vaginal involvement	1	1	10	7	1	5	2	0	2	1	3	0	2
Marked vaginal involvement	1	1	4	3	3	3	2	0	3	1	2	1	0
Type of operation													
Combined	1	1	2	0	0	1	0	0	0	1	1	0	0
Vaginal panhysterectomy	4	0	2	3	1	2	0	1	2	0	0	0	1
Abdominal panhysterectomy	5	5	12	11	6	8	4	0	6	2	4	2	2
Dilatation and curettage	4	3	3	5	3	4	0	1	5	0	2	0	0
Living and well													
Number	5	2	0	4	2	3	1	0	0	1	0	0	0
Per cent	50	33.3	—	28.5	28.5	27.2	25	—	—	33.3	—	—	—
Dead or lost, but living or traced 5 years or more after operation													
Lost or death not due to cancer	2	0	1	0	0	1	0	0	0	0	0	0	0
Recurrence	1	0	1	1	2	0	0	0	0	0	1	1	

*One patient had ovarian metastasis.

their symptoms before coming to operation. These 8 patients, according to our criteria, were beyond the scope of a permanent operative cure.

It would be reasonable then to say that of the 30 patients in this group of cancers, 8 belonged to the inoperable class. Therefore, of the 22 remaining patients who were operable, 14 (63.6 per cent) are either living and well or may reasonably be considered as operative cures.

TRANSITIONAL CELL CANCER

The transitional cell cancer is by far the most common variety. Grossly it does not differ nor can it be distinguished from the other cancers in this situation. Microscopically, however, this tumor is distinctive, its cells resembling somewhat a well defined zone of cells seen in normal cervical epithelium, which is limited above by the characteristic spinal cell layer and below by the distinctive single celled basal layer. Because of their resemblance to this intermediate group of cells we have designated this variety of cancer as the transitional cell type. These cancer cells have a very faint or undefinable cell membrane. The nuclei take a deep blue hæmatoxylin stain and are closely placed, being separated by a deep eosin staining cytoplasm much less in quantity and more deeply staining than that in the spinal cells. Nucleoli are commonly observed (Fig. 3).

In Table VIII are tabulated the salient features regarding the patients having the transitional type of cancer.

Metastases to the iliac glands were demonstrable in 4 patients of this group, all but one dying in less than 1 year after operation. This patient who came for treatment in the ninth month of symptomatic disease died 2 years after operation. She was the only one of the four to have a diagnostic curettage several days prior to operation for radical extirpation of the process.

Metastases to the fallopian tubes were demonstrated twice in this group, both of the patients dying of recurrent cancer, though one who had had symptoms for 3 months lived 6 years before succumbing, 5 of these years being spent in complete comfort until the recurrence began to manifest itself.

Involvement of the corpus uteri by the cervical cancer occurred in 17 instances (18.8 per cent) in the transitional type of cancer, but in contrast to our results in the spinal cell group, none of these patients may be classified as cured. Of these 17 patients, 3 lived two years or more following operation, one 4 years, one 2 years, and one 3 years, the duration of their symptoms at the time of operation being respectively 5, 9, and 24 months. Of these 17 patients having extension of the cancer to the uterus, 3 (17.6 per cent) had no associated pericervical involvement. This absence, however, did not seem to indicate a more favorable outcome, in so far as an ultimate cure was concerned.

Pericervical extension of the malignant process occurred in 37 instances (41 per cent) though it was questionable in two. All of these patients, however, died of cancer. In our pre-

TABLE IX. SUMMARIZING THE PATIENTS WHO CAME TO THE JOHNS HOPKINS HOSPITAL DURING THE FIRST SIX MONTHS OF THEIR SYMPTOMS IN ORDER TO SHOW THE INCIDENCE OF THE CASES AS THEY CAME TO THIS CLINIC AND THEIR CORRESPONDING INCIDENCE OF BROAD LIGAMENT INVOLVEMENT IN OPERATED OR AUTOPSIED CASES

Predominant cell type	Total number	Total number operated upon or autopsy done in first 6 months	Broad ligament involved in first 6 months	Percentage of autopsy or operated cases in first 6 months	Percentage of broad ligament involved in first 6 months
Transitional.....	200	140	45	70.0	32.1
Fat spindle.....	33	18	7	54.5	38.8
Spinal.....	49	29	2	59.1	6.8
Adenocarcinoma..	19	6	2	31.5	33.3

(Martzloff, K. H. Johns Hopkins Hosp. Bull., May, 1923, xxxiv, page 146.)

TABLE IX, A. PATIENTS WITH TRANSITIONAL TYPE OF CANCER WITH PERICERVICAL INVOLVEMENT LIVING THREE YEARS OR MORE AFTER OPERATION BEFORE EVENTUALLY DYING OF CANCER

Duration of symptoms months	Duration of life after operation years	Cervical involvement Thickness	Cervical involvement Length	Radium	Primary dilatation and curettage
3	6	One-third	Two-thirds	o	o
4	5	Entire	Entire	Yes	Yes
5	7	Entire	Two-thirds	o	o
9	*8	Two-thirds	Entire	o	Yes
12	3	Entire	Entire	o	o
18	12	Entire	Entire	o	o
24	†3	Entire	Entire	o	o

*No vaginal involvement
†Limited vaginal involvement

vious communication we drew attention to the frequency of early pericervical involvement in this group of cancers which is here reproduced in Table IX and this is again borne out in this selected group of patients.

These patients, with the exceptions noted in Table IX, A, all died within 2 years after operation.

Vaginal involvement was extensive in 24 patients of this group. Only 2 (8.3 per cent) of these, however, may be classed as cured. In fact, of the 18 patients who are "well" only 6 (36.6 per cent) showed cancerous invasion of the vagina, the involvement in 4 (22.2 per cent) being not extensive, while in 2 (11.1 per cent) the vaginal invasion was more widespread though removable.

TABLE X. SHOWING INVOLVEMENT OF THE CERVIX IN THE CURED PATIENTS WITH TRANSITIONAL CELL CANCER

Duration of symptoms months	Thickness of cervix involved: One-third	Two-thirds	Entire
1	5	o	o
2	2	o	o
4	2	2	o
5	o	1	1
6	2	o	1
7	o	o	1
10	1	o	o
	12 (66.6%)	3 (16.6%)	3 (16.6%)

The extent of cervical involvement in relation to the "cured" patients is interesting in this group of cancers. In Table X are grouped the "cured" patients to show the degree of cervical implication.

From this table, it is readily seen that of the "cured" patients in this group twice as many had one-third or less of the cervical thickness involved in cancer as compared with those having more extensive involvement. These findings are considerably at variance with those for the spinal cell type of cancer and are sufficiently striking to suggest that radial cervical involvement may be an important factor in the determining of the operative curability of the transitional type of cancer.

This is all the more vividly brought out when one considers the number of cured patients occurring in each of the groups into which the thickness of cervical involvement is subdivided. Of 21 patients in whom one-third or less of the cervical thickness was involved in cancer, 12 (57.1 per cent) were cured. Of 23 patients who had two-thirds of the radius of cervix invaded by cancer, 3 (13 per cent) are well, while of the 46 patients in whom the entire thickness was involved, 3 (6.5 per cent) may be considered cured.

These figures lose their striking importance somewhat when one considers that during the first 8 months of the disease the incidence with which one-third, two-thirds, and the entire cervical thickness respectively were invaded was 95, 86, and 65 per cent. However, despite this, the figures in the preceding paragraph remain of dominate importance.

Table XI brings out plainly the situation existing in the group of patients who were seen during the first 8 months of their symp-

TABLE XI.—SHOWING THE RELATION OF THE EXTENT OF RADIAL INVOLVEMENT OF THE CERVIX TO THE INCIDENCE OF OPERABLE AND CURED PATIENTS WITH TRANSITIONAL CELL CANCER

	One-third of cervical thickness involved in cancer				Two-thirds of cervical thickness involved				Entire thickness involved			
Duration of symptoms	Total No. of patients	Operable patients	Cured patients	Percentage cures in operable cases	Total No. of patients	Operable patients	Cured patients	Percentage cures in operable cases	Total No. of patients	Operable patients	Cured patients	Percentage cures in operable cases
1 mo.	8	8	5	62.5	2	1	0	0	0			
2	3	3	2	66.6	2	0	0	0	1	0	0	
3	3	2	0	0	6	6	0	0	7	1	0	0
4	3	3	2	66.6	4	3	2	66.6	7	3	0	0
5	1	1	0	0	2	2	1	50	4	1	1	100
6	2	2	2	100	4	4	0	0	5	1	1	100
7	0				0				4	1	1	50
8	0				0				1	1	Lost	
Total	20	19	11	57.8	20	16	3	18.7	29	8	3	37.5

toms in so far as the extent of radial cervical involvement is concerned. One is impressed at once by the high incidence of cures in the operable cases and the relatively low incidence of operable cases among those patients in whom the entire cervix was involved. It is also impossible not to be impressed with the scarcity of cures in the group in which the radial cervical involvement is limited to two-thirds, despite the high incidence of operability, in so far as demonstrable ineradicable extension is concerned.

Type of operation performed. In this group 7 patients were submitted to the combined vaginal and abdominal panhysterectomy. All but 3 died in less than 1 year after operation. Of the 3 exceptions one lived 4 years, and the two others, 2 years, the duration of symptoms before operation being respectively, 1 month, 2 months, and 6 months.

On 16 patients (17.7 per cent), a vaginal panhysterectomy was performed and 4 (25 per cent of 16) are living and well. Three of these patients were in the first month of their symptoms, while the remaining one was in the sixth month.

The most common operation was the abdominal panhysterectomy, which was done in 67 instances (74.4 per cent). Of these patients 14 (20.8 per cent of 67) are living and well.

The occurrence of 5-year "cures" in the patients operated upon by either the vaginal or abdominal route is, respectively, 43.7 per cent of 16 and 34.3 per cent of 67 patients.

Curettage of the cervical neoplasm several days prior to radical operation was done on 30 (33.3 per cent) patients in this group. Of these, 7 (23.3 per cent of 30) are living and well, while 11 (36.6 per cent of 30) can be considered as belonging to the group of 5 year "cures."

In other words, of the 18 patients living and well, 7 (38.8 per cent) had been curetted several days prior to the complete extirpation.

Duration of symptoms. A word should be said here concerning patient number three in the group whose symptoms are of 10 months' duration. In this as well as in our previous study, this case has caused difficulty from the standpoint of proper classification as to the duration of symptoms. Her history could well have been construed in such a way as to make the duration of her symptoms much shorter. This would also seem reasonable in view of the evident incipiency of the neoplastic process as indicated by our histological

TABLE XII. CURED PATIENTS IN THE TRANSITIONAL CELL GROUP

	Cases
Total number of patients in this group	90
Five-year cures (33.3%)	30
Operable patients	46
Operable patients permanently cured (39.1%)	*18

*If to this number are added four operable patients who died or were lost 7, 8, and in two instances 10 years after operation without evidence of recurrence, we would have an operative cure in 47.8 per cent.

TABLE XIII.—SPINDLE CELL CANCER

	Duration of symptoms in months									
	3	4	5	6	7	8	9	12	18	24
Number of patients	4	1	1	2	1	2	2	1	2	1
Extension of metastases										
Iliac glands	1	0	0	0	0	0	0	0	1	0
Fallopian tubes	0	0	0	0	0	0	1	0	0	1
Uterus	2	0	0	0	0	0	2	1	2	1
Bladder	0	0	1	0	0	0	2	0	0	0
Pericervical tissues	2	0	1	1	0	0	2	1	2	1
Moderate vaginal involvement	1	0	0	0	1	1	2	1	0	0
Marked vaginal involvement	2	0	1	2	0	1	0	0	2	1
Type of operation										
Combined	1	0	1	0	0	0	0	0	0	0
Vaginal panhysterectomy	0	1	0	0	1	2	1	0	0	0
Abdominal panhysterectomy	3	0	0	2	0	0	1	1	2	1
Dilatation and curettage several days prior to major operation	4	0	1	0	0	0	0	0	0	0
Living and well										
Number	1	0	0	0	0	0	0	0	0	0
Per cent	25	—	—	—	—	—	—	—	—	—
Recurrence	0	0	0	0	0	0	0	0	1	0

findings. Were it not for the exception just mentioned, it would appear that every patient whose symptoms had extended over a period of 8 months or more before operation, was probably beyond the scope of an operative cure.

Cures. Of the patients in this group, 18 (20 per cent) are living and well though these percentages could be raised to 24, if one were to consider cured those who died of natural causes or those that were lost after a period of 10 years. This has not been done, however, these patients being grouped with those in the last column to swell the number of 5 year cures which totals 30 patients (33.3 per cent) and comprises those living and well, as well as those living 5 or more years before dying or not being traceable.

Percentage cure in operable patients. The question necessarily arises as to what the ultimate results would be in patients who may be considered in the light of our experience to come within the scope of operability. In this group of cancers it would appear from our findings that in addition to the criteria established for the spinal cell cancers, one should add extension of the cancer to the corpus uteri as one other factor indicating the possible improbability of an operative cure.

Therefore, if we consider inoperable in this group of cancers, the 37 patients with pericervical extensions of the growth, 3 patients with uterine extensions and 1 with ovarian involvement not included in the previously mentioned 37, we have 41 patients (45.5 per cent) out of the 90 who are definitely beyond the scope of a permanent operative cure. If we may also consider any patient whose symptoms are over 10 months in duration as being beyond operative reclamation, we may add 3 more to the inoperable group making a total of 44 patients (48.8 per cent) out of 90 who presumably were beyond the reach of an operative cure.

We may, therefore, reasonably consider 46 patients in this group to be operable. This then gives us a permanent operative cure in 18 patients or 39.1 per cent of those whom we consider as coming within the scope of a possible operative cure. If the 4 operable patients who died or were lost 7, 8, and in two instances 10 years after operation without evidence of recurrence, were reckoned as cures, we would then have a 47.8 per cent operative salvage among the operable patients with this type of cancer.

SPINDLE CELL CANCER

In our first communication the cancer cell characterizing this group of cancer was referred to as the "fat spindle type of cancer cell." This latter designation is unwieldy, and it would probably be less cumbersome to refer to this cell as the spindle type of cancer cell, and to designate this group as the spindle cell cancers.

This group forming the least common variety of the epidermoid cancers of the cervix is composed of cells which, as their name implies, are spindle shaped. Their nuclei assume a deep hæmatoxylin stain, are closely placed and separated by only a small quantity of eosin-staining cystoplasm. Nucleoli are occasionally, but not commonly seen (Fig. 4).

The spindle cell group for this particular study comprises 17 patients. In Table XIII

are tabulated the outstanding features characterizing the disease in this group of cancers.

TABLE XIV. CURED PATIENTS IN THE SPINDLE CELL GROUP

	Number
Total number of patients	17
Five year cures (11.7%)	2
Operable patients	7
Operable patients permanently cured (14%)	1

Iliac gland metastases were noted in two instances, in both associated with extensive cervical and vaginal involvement as well as extension into the pericervical tissues. One of these patients with symptoms of 3 months' duration, lived 1 year after operation and the other whose symptoms were of 18 months' duration lived 6 years before dying from the effects of a recurrence.

Fallopian tube involvement occurred in 2 patients, in each instance the uterus and pericervical tissues were also implicated. One of these patients lived 1 year after operation and was lost trace of, while the other whose symptoms were of 24 months' duration lived 2 years before succumbing to a recurrence.

Involvement of the corpus uteri occurred in 8 patients (47 per cent) of this group. One of these patients (12.5 per cent of 8) is living and well, while another lived over 5 years before dying of a recurrence. It is noteworthy that with one exception all of the patients in this group with extension of the cancer to the corpus uteri also had pericervical involvement. The exception is the one and only patient in the group who is living and well. The uterine extension in her case is not associated with pericervical extension.

Involvement of the pericervical tissues occurred in 10 patients (58.8 per cent). All except one died of recurrent cancer. This patient died 2 years after operation as the result of a cardiopathy (clinical diagnosis), there being at that time no clinical evidence of a recurrence.

Vaginal involvement in the carcinomatous process occurred in 15 patients or approximately 88 per cent of this group. From this phase of the pathology, little can be deduced that might serve to determine anything of prognostic significance in the spindle cell cancers.

The extent of cervical involvement in this group is also not particularly relevant in so far as ultimate cure or postoperative longevity are concerned, because no definite relation can be shown between them.

The types of operation performed are readily seen at a glance and are not particularly relevant except possibly to note that of the 10 patients who had abdominal panhysterectomies performed, 40 per cent lived 2 years or more after operation, while out of the 5 submitted to the vaginal operation only one (20 per cent) lived as long. On only 2 patients in this group was the combined vaginal and abdominal operation performed, and one of these (in the third month of symptoms) lived 2 years before dying of a recurrence.

Curettage of the neoplastic process several days prior to the radical operation for extirpation was performed in 5 instances, and the only patient in this group now living is one on whom this procedure was carried out.

Duration of symptoms. What influence the duration of the symptoms before operation exerts on the ultimate outcome in spindle cell cancer is difficult to determine. The number of patients in this group is so small that any deduction would appear arbitrary. It may, however, be noted that after the eighth month of symptoms every patient had pericervical extension of the neoplasm. This alone, as previously demonstrated, in our experience precluded all hope of an operative cure, and from that standpoint renders the case inoperable. However, a patient may live for several years in complete comfort before succumbing to recurrent cancer.

One might therefore presume that any patient with spindle cell cancer of the cervix with a history of over 8 months' duration, should be considered inoperable in so far as a permanent operative cure is concerned.

Operable cases. The criteria for operability in the spindle cell group of cancers are probably similar to those recognized for the spinal cell group, in view of the fact that uterine involvement by the carcinomatous process does not altogether exclude the probability of an operative cure, provided, of course, that uterine extension is not associated with pericervical invasion.

It will be noted that all patients in this group with iliac gland or fallopian tube involvement also had extension of the process into the pericervical tissues. This is also true of the patient with bladder involvement. We may consider the 10 patients with pericervical extensions of the cancer as being beyond the scope of an operative cure. These 10 cases include those mentioned in the previous paragraph, and also those whose symptoms are over 8 months in duration. Therefore, of the 17 patients who are now under consideration 7 (41 per cent) may be considered operable.

Cures in this group are of less frequent occurrence than in any of the preceding groups, only 1 patient (5.9 per cent of 17) being alive and well today. Five-year cures amount to 11.7 per cent, and in this connection it is interesting to note the extensive involvement with metastases of the patient who lived 6 years after operation before succumbing to recurrent cancer.

In any consideration of cured patients, we are necessarily concerned with the possibility of cure in those who are operable. In view of the fact that only 7 patients in this group come within the scope of operability, the one cured patient gives us an operative cure of 14 per cent in the operable cases.

ADENOCARCINOMA

Nine patients in this study had adenocarcinoma as the type of neoplasm involving the cervix. Table XV gives the salient features encountered in this variety of cancer.

Adenocarcinoma is the rarest type of cervical cancer but unlike the rarest form of the epidermoid variety does not possess a similar degree of malignancy. All but two of the patients in this group who died of cancer lived 2 years or more after operation, one living 2, one 3, and two 4 years before succumbing to a recurrence. In brief, of the 6 patients in this group who died of recurrence 4 (66 per cent) lived 2 years or more after operation.

Ovarian involvement occurred in one patient (11 per cent) operated upon during the fourth month of the disease and was associated with tubal, uterine, and pericervical extensions.

Corpus uteri. The neoplasm invaded the body of the uterus in two instances (22 per cent). In both there was associated pericervical extension of the cancer with complete involvement of the cervix and the ultimate result was fatal. In this group, therefore, involvement of the corpus uteri was uniformly fatal and the outcome to be anticipated in view of the associated pericervical involvement.

It is here impossible to predict the influence that extension to the corpus uteri without pericervical involvement might have on the final outcome in a given instance.

Bladder involvement occurred once in this group in a patient whose symptoms were of 24 months' duration. The involvement was by direct extension and the outcome fatal 3 years after operation with the employment of radium.

Pericervical extension of the neoplasm occurred in five instances (55.5 per cent). All of these patients died.

Vaginal extension of the cancer occurred in two-thirds (6) of these patients. Where this extension was uncomplicated by radial pericervical extension of the cancer, a cure was obtained in 2 out of the 3 patients (66.6 per cent of 3) so affected. It is obvious, therefore, that vaginal encroachment by adenocarcinoma of the cervix does not preclude an operative cure.

The study of cervical involvement is not particularly relevant except to show that 2 of the

TABLE XV.—ADENOCARCINOMA

	Duration of symptoms in months.							
	2	4*	6	9	10	12	18	24
Number of patients	1	1	1	2	1	0	1	2
Extension of metastases								
Iliac glands	0	0	0	0	0	0	0	0
Fallopian tubes	0	1	0	0	0	0	0	0
Uterus	0	1	0	0	1	0	0	0
Bladder	0	0	0	0	0	0	0	1
Pericervical tissues	0	1	1	1	1	0	0	1
Moderate vaginal involvement	0	1	1	1	1	0	0	0
Marked vaginal involvement	0	0	0	0	0	0	1	1
Type of operation								
Combined	0	0	0	0	1	0	0	0
Vaginal panhysterectomy	0	1	0	0	0	0	0	0
Abdominal panhysterectomy	1	0	1	2	0	0	1	2
Dilatation and curettage several days prior to major operation	0	0	0	1	0	0	0	1
Living and well	1	0	0	1	0	0	0	1

*One patient had ovarian metastases.

TABLE XVI. CURED PATIENTS SUFFERING WITH ADENOCARCINOMA

		Number
Total number of patients		9
Cured	(33.3%)	3
Operable		4
Cures in operable patients	(75%)	3

TABLE XVII.—SHOWING THE PROGNOSIS THAT MAY BE PREDICTED IN PATIENTS SURVIVING OPERATION WHEN CONSIDERATION IS GIVEN THE PREDOMINANT CELL TYPE AND THE FACTORS GOVERNING OPERABILITY IN CANCER OF THE CERVIX UTERI

Type of cancer	Number of cases	Histologically or chronologically beyond scope of permanent cure (inoperable)	Operable	Cured	Percentage of operable cases cured
Spinal cell	30	8	22	14	63.6
Transitional cell	90	44	46	18 *(22)	39.1 *(47.8)
Spindle cell	17	10	7	1	14
Total for epidermoid cancers	137	62	75	33 (37)	44 (49.3)
Adenocarcinoma	9	5	4	3	75
Total	146	67	79	36 (40)	45.5 (50)

*To this number might well be added four other patients who were operable and died or were lost 7, 8, and in two instances 10 years after operation without evidence of recurrence. This would yield the results indicated by the figures in parentheses.

3 cured patients had the entire cervix involved in cancer.

Type of operation performed. The two patients on whom a vaginal panhysterectomy was performed had extension of the cancer which made the condition incurable. The abdominal panhysterectomy was done on the remaining seven.

Diagnostic curettage several days prior to operation was done twice in this group. One of these patients is alive and well. So one may conclude that curettage not followed by immediate operation is not incompatible with an ultimate operative cure.

Duration of symptoms. It is difficult, in fact, obviously impossible, from a study of Table XV to formulate any rule as to a time limit based on symptoms beyond which a case of adenocarcinoma of the cervix is to be considered inoperable. In this respect, it differs entirely from the others heretofore described.

Cures. Of this group 3 patients are living and well today giving an ultimate "cure" of 33.3 per cent. Reference to Table XV shows the duration of symptoms before operation, and it is little short of marvelous to note that one patient had had outspoken symptoms for more than 2 years. The symptoms in this instance were a profuse, malodorous, vaginal discharge and a well defined metrorrhagia attributable to no demonstrable endometrial or myometrial abnormality. This patient is living 14 years after operation, and 3 years ago underwent a radical breast amputation for cancer.

Other than these 3 there are no 5 year cures in this group.

Cures in operable cases. Although 33.3 per cent represents the operative cures in this group of cancers, it does not indicate the outcome to be anticipated in patients who come within our conception of operability. A glance at Table XV will immediately reveal that 5 (55.5 per cent) of these patients had extensions of the cancer beyond the radial confines of the cervix thereby losing all chance of operative cure. The five cases just mentioned also include all other extensions and metastases except those involving the vagina.

The incidence of operable patients in this group, therefore, is 44.4 per cent. The incidence of operative cure in these operable cases is 75 per cent, thereby surpassing even the spinal cell cancers in the favorable prognosis that may be offered in the operable patients who survive their operation. This is an wholly unforeseen result and was altogether unanticipated when the present study was undertaken.

SUMMARY

This study was planned primarily to ascertain, if possible, the factors that influence the chances of an operative cure in a patient suffering with cancer of the cervix uteri, *provided she survives the immediate effects of the operation.* Certain features are here briefly indicated upon which a prognosis may possibly be based.

Extension and metastases when demonstrable in either the regional lymph nodes, the adnexa, bladder, rectum, or pericervical tissues, render impossible an ultimate operative cure.

Uterine extension of the cancer without extension elsewhere evidently impairs the chances of an operative cure, but by no means obviates it in spinal cell cancer. In the transitional cell type, extension to the corpus uteri apparently outrules any operative cure. No generalization on this phase is permissible in the adenocarcinomata or in the spindle cell

cancers. It must be mentioned, however, that in the latter group the only cured patient had extension of the cancer to the body of the uterus.

Extension to the vagina of the neoplasm in patients who could otherwise be operated upon warrants a more unfavorable prognosis than uterine extension in the spinal cell cancers. Other factors being about equal, it might be said that the prognosis for an ultimate operative cure for vaginal extension as compared to uterine extension is as 1 is to 1.4. This complication is most serious in the transitional cell cancer and is least serious of all in the adenocarcinomata. No generalization is warranted for the spindle cell cancers.

Duration of symptoms before operation. It would appear justifiable on the basis of our study to say that in the spinal and transitional cell cancers, a duration of symptoms exceeding 8 months is sufficient to put the patient beyond the scope of an operative cure. In the case of the spindle cell cancers, our study would indicate that this time limit is probably too liberal. For the adenocarcinomata, no such stringent or arbitrary duration of symptoms can be predicated as for the cancers of the epidermoid variety.

The degree of cervical involvement provided there is no pericervical involvement appears to be a relatively unimportant factor in the spinal cell cancers as well as in the adenocarcinomata. In the case of the transitional cell cancers, however, the degree of radial cervical involvement immediately assumes an important rôle, so that of the cured patients those having one-third or less of the thickness of the cervix involved in cancer as compared with those having more extensive involvement, are as 2 is to 1.

In fact, patients with transitional cell cancer seen during the first 8 months of their symptoms, who have only one-third of the thickness of the cervix involved, present an operability incidence of 95 per cent, and the cures obtained in this operable group are 57.8 per cent. This is in distinct contrast to an operability incidence of 15 per cent and cure incidence of 17.6 per cent in the patients having two-thirds of the cervix involved or an operability incidence of 31 per cent with a cure incidence of 33.3 per cent if the entire cervical thickness is involved.

No generalization can be made for the spindle cell cancers.

Diagnostic curettage performed several days prior to the radical operation was done in 10 patients with spinal cell cancer and 21.5 per cent of these are well today. Of the transitional cell cancer patients who are living and well, 38.8 per cent were curetted several days prior to operation. In the spindle cell cancer group, 5 patients were curetted. This includes the only patient in this group who is well today. Curettage was performed twice in the group of adenocarcinomata and one of these patients is well at the present time.

Undoubtedly, curettage for diagnosis several days prior to operation for radical extirpation does not render the prognosis hopeless.

Prognosis in operable patients. In the group of epidermoid cancers the spinal cell cancer offers the most favorable prospect for operative cure. Provided our criteria of operability are accepted, a cure may be anticipated in 63.6 per cent of the operable cases of spinal cell cancer who survive the operation.

The transitional cell cancer comes next, offering the possibility of a cure in 39 to 47 per cent of its sufferers, while the spindle cell cancers are the least hopeful of all in that only a 14 per cent cure is revealed in our study.

The adenocarcinomata offer the most hopeful outlook, in that 75 per cent of the operable cases may be considered cured. However, we must again point out the small number of patients in this group and the danger of accepting without qualifications deductions formulated on such premises.

Minimal requirements of an adequate operation for carcinoma of the cervix uteri are presented. It is also apparent that in this restricted group of patients operated upon 45.8 per cent were evidently beyond the hope of cure by operation.

CONCLUSION

A postoperative prognosis in carcinoma of the cervix uteri can be made provided that the tissue removed at operation is studied with sufficient care, and that an adequate operation is performed by a surgeon ade-

quately trained in the surgery of the female pelvis. In these circumstances the prognosis may be rendered on as rational a basis as in cancer of the lip or breast.

Surgery has a definite place in *properly selected* cases for the treatment of cancer of the uterine cervix.

NOTE.—Since radiologists are classifying their patients according to the scheme outlined by the American College of Surgeons, it may prove interesting to group the cured and operable patients in this study in a similar manner. According to this classification Class 1 represents all primary cervical cancers. Classes 2 and 3 represent recurrent cancers after hysterectomy and Class 4 represents cancers developing in the cervical stump. Class 1 is again divided into groups or subdivisions, viz.: (a) early favorable, cancer confined entirely to cervix; (b) borderline, extension of cancer to vagina or uterus; (c) broad ligaments involved (as evidenced by pericervical induration); (d) advanced cases.

The cured patients as compared with the operable ones in this study would, therefore, be classified as follows:

	Cured	Operable
Spinal cell cancer	14	22
Class 1, a	1	3
Class 1, b	10	14
Class 1, bc	2	4
Class 1, c	1	1
Transitional cell cancer	18	46
Class 1, a	10	22
Class 1, b	2	14
Class 1, bc	4	6
Class 1, c	1	3
Class 4, a	1	1

Spindle cell cancer—1 case cured belonging to Class 1, b.

Of the 7 cases in this group 2 belong to a, 3 to b and 2 to bc.

	Cured	Operable
Adenocarcinomata	3	4
Class 1, a	1	1
Class 1, bc	2	2
Class 1, b	0	1

The patients who have been placed in group C in the above classification presented clinical broad ligament induration, but no histological extension of the cancer beyond the confines of the cervix uteri. Reference to Tables VI, X, and XI will indicate the extent of cervical involvement in cancers of the spinal and transitional cell type.

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OVARIAN IRRADIATION; ITS EFFECT ON THE HEALTH OF SUBSEQUENT CHILDREN

Review of Literature, Experimental and Clinical, With a Report of Three-Hundred and Twenty Human Pregnancies

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THE Gynecean Hospital Institute of Gynecologic Research of the University of Pennsylvania is studying the effects of irradiation upon the ovary. The chief point of interest in this investigation is the health of subsequent offspring. Extensive animal experiments are being undertaken to determine the effect of ovarian irradiation on the health of the descendants of the irradiated animals.

The subject is being studied for two reasons: first, year by year radium and the X-ray are being used more frequently in the treatment of non-malignant pelvic diseases of women; second, many of these treatments are given during the childbearing period, in amounts insufficient to produce permanent sterility. Women so treated have subsequently borne children, but because some of these children presented developmental defects, this gave rise to the belief that they were produced by the maternal irradiation.

The present study is undertaken in the hope of learning whether the defects described are due to the maternal irradiation or to other causes. If these defects are due solely to irradiation, this should be well understood, in order to prevent their future occurrence.

This article is intended as an introductory paper to further studies upon ovarian irradiation. In it the contemplated investigation is outlined, and the animal experimental and clinical evidence, as set forth in the current literature, is reviewed.

OUTLINE OF CONTEMPLATED STUDY

On account of the importance and complexity of the problem, only a single aspect of ovarian irradiation is being studied. The health of offspring, born following therapeutic maternal pelvic irradiation, was selected as perhaps the most important clinical phase of the problem needing investigation.

This research is both a clinical and an experimental one. The clinical portion consists of an analysis of the health conditions of children born of mothers receiving therapeutic pelvic radium or X-ray irradiation, either before or during the pregnancies concerned. The material for the present communication was secured from reports found in the current medical literature.

The second part of the clinical portion consists also of an analysis of the physical condition of children born of similarly irradiated mothers, but as yet unreported. These data are being gathered from questionnaires sent to various observers and clinics throughout the United States.

The animal experimental portion of the work consists of observations made upon the progeny of white rats. Only one generation of females is receiving ovarian irradiation prior to mating, in order to permit a study of the inheritance of any possible defects induced by such treatment to be made. This investigation is being supplemented by histological observations made upon the changes observed in the ovaries of rats thus treated.

Review of Literature, Experimental and Clinical

EXPERIMENTAL STUDIES

The observations of thirty-seven workers have been studied in order to ascertain what experimental evidence there is at hand to indicate the part played by irradiation in the production of defective offspring in animals. For want of space the abstracts of these experimental studies have not been recorded in detail. The references to them appear in the bibliography from 1–41 inclusive.

These observations have been made upon a variety of animals and in most instances evidence has been found, indicating that the

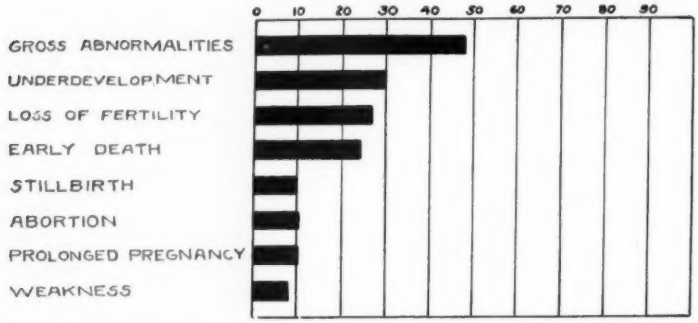

Fig. 1. Irradiation effects upon animal and human offspring. Showing the relative frequency of the more important sequelæ resulting from irradiation, as such treatment affects the health of the irradiated animal, but more especially the health of the offspring, as observed in 37 different experimental studies upon a variety of different animals. These sequelæ are charted regardless of whether irradiation preceded or followed fertilization, and do not register true percentages since negative statements concerning each finding were not always recorded.

young of these irradiated female animals suffered injury because of the maternal treatments. The chief disturbances observed, in the order of their frequency are presented graphically in Figure 1. In this diagram, loss of fertility and prolongation of pregnancy, refer to the irradiated mothers and not to the offspring. From this diagram it appears that gross abnormalities among the young of irradiated mothers are not infrequent, and underdevelopment and early death are also important sequelæ.

The observations on Figure 1 were recorded irrespective of the time, with regard to fertilization, at which the irradiation took place. In Figure 2 the same data are graphically presented, but in a different fashion. Here the black bars represent the sequelæ observed when irradiation preceded pregnancy or fertilization of the ovum, whereas the cross-hatched bars represent the effects of irradiation administered during pregnancy or after fertilization of the ovum had taken place. In the latter case the developing embryo was directly irradiated, and here there was a decided increase in the frequency of gross abnormality production. Figure 2, based on a small series of experiments upon a wide variety of animals and insects, presents contrasts between preconception and post-conception effects, which may give erroneous impressions as a result of these facts, namely the small amount of material and the conditions under which they were carried out.

In a number of the animal experiments forming the bases of Figures 1 and 2, only a small series of animals was employed, and in some of these experiments no controls were used. It is quite possible that if more thorough and complete observations had been made, the final results would have been different.

For the purpose of making easier comparison, Figures 1 and 2 have been drawn to a scale of one hundred. These results do not, however, represent true percentages, since in most of the reports examined, negative statements were not recorded for each of the findings charted. This fact, however, ought not to alter our opinion concerning the great frequency of gross abnormality production as recorded in Figure 2.

The great frequency of occurrence of gross abnormalities among the young of animals irradiated when pregnant, or after fertilization of the egg, as the case may be, would seem to prove that the irradiation was the cause of the disturbances observed. Most of the experiments in the series studied were carried out upon the fertilized egg. The few remaining studied—some six or seven in number—upon *pre-fertilization* irradiation *suggest* that subsequent offspring may suffer as the result of preconception irradiation. The evi-

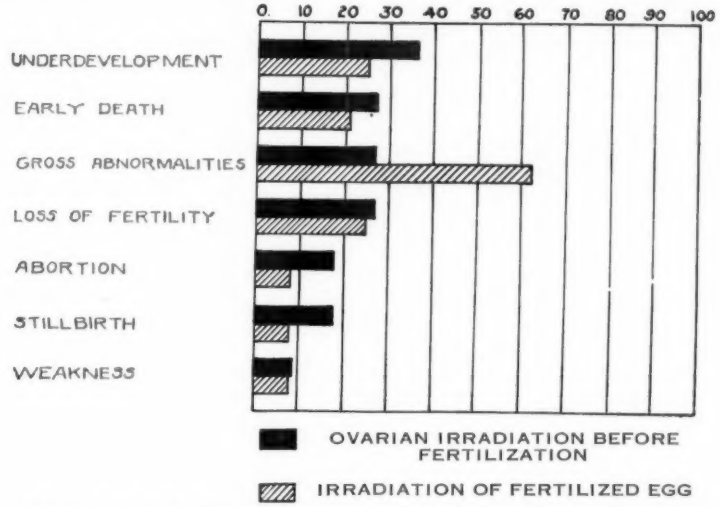

Fig. 2. Irradiation effects upon animals and their offspring. Data presented here are the same as on Figure 1, only plotted according to whether the irradiation was received before or after fertilization of the egg. Note the high frequency of gross abnormality production when the fertilized egg is irradiated. The small number of experiments (37), the wide variety of animals and insects employed, the absence of negative findings in many of the reports and certain other factors such as the disproportion of preconception experiments (7) as against the larger number of postconception experiments (30) make a correct appreciation of the various findings charted here extremely difficult.

dence confirming this belief is as yet by no means abundant, nor is it believed to be more than suggestive of damage. For this reason additional experimental and clinical evidence is deemed necessary before a final satisfactory answer to this problem can be given.

Pre-fertilization irradiation of animals. Pre-fertilization ovarian irradiation has been found to delay the onset of pregnancy in rabbits (Zaretsky, 41), but to be followed by the production of normal young. Prolongation of pregnancy has also been observed to follow this form of irradiation (Driessen, 10; Lacassagne and Coutard, 21), as has likewise abortion (Trillmich, 38; Bergonie and Tribandeau, 5). Stillbirth has been observed by Trillmich, (38), Driessen (10), Lacassagne and Coutard (21). Early death of offspring has been noted by Okintschitz (30) when irradiating mice, and by Sebileau (35), Driessen, Lacassagne and Coutard when irradiating rabbits. Underdevelopment has also followed preconception irradiation (Driessen, Lacassagne and Coutard), and Driessen has observed general weakness of the offspring after the treatment. Gross abnormalities have been noted by Lacassagne and Coutard, and in this country Bagg and his co-workers have apparently demonstrated the presence of gross abnormalities in mice, apparently the result of maternal irradiation. Bagg, in a personal communication, states that he has been unable to reproduce the original defects in a second set of similar experiments.

In addition to the gross changes seen by the above writers, certain of the cytologists (Mavor, 26; Muller, 27) have observed striking effects in the structure of individual cells, especially in the nucleus, following irradiation. It has been shown that irradiation may disrupt the normal chromosome arrangement in the nucleus without altering the viability, and that following such treatment atypical monsters may be produced. Hinrichs, who recently reviewed the literature on irradiation effects upon living tissues, says that:

1. The chromatin is more susceptible to irradiation than is the rest of the cell.

Fig. 3. Ages of women at time of irradiation treatment. Polygon curve showing the ages of 177 women receiving pelvic irradiation, plotted according to the number of such treatments per year.

2. The dividing cell is more susceptible than the resting cell.

3. Embryonic, rapidly differentiating tissues are more susceptible than adult tissue.

4. Weak dosage may accelerate, whereas strong dosage delays, cell activity.

5. The more intense the irradiation and the earlier it is applied, the more marked are the defects.

6. The effect is more pronounced in systems where development is most precocious, such as the nervous system and the vascular system.

Discussion of experimental data. All the experimental data indicate that *irradiation of the developing animal embryo* is a procedure that is extremely prejudicial to the future health of that individual. This evidence is convincing, both in its quantity and in its quality.

Such a statement cannot be made without reservation, as regards the question of *preconception or pre-fertilization irradiation* in animals. Nevertheless, the available evidence in favor of such damage being possible is highly suggestive.

The facts in support of this suggestion are:

1. That evidence has been presented by various observers.

2. That this evidence has been confirmed by experiments upon different kinds of animals.

3. That other agents, such as alcohol, etc. (see Stockard) when parents are subjected to their influence in sufficiently large amounts, are known to injure the health of offspring.

4. That more than one biologist has been able to observe cellular changes affecting the hereditary mechanism, namely, the chromosome arrangement of the nuclei, following irradiation, and later has been able to confirm this by the appearance of atypical offspring.

Such evidence as that just cited would indicate that *pre-fertilization irradiation, in the case of human beings*, might act injuriously upon the health of children born following such maternal treatments. Arrayed against the fact that preconception irradiation may injure the health of children born subsequent to maternal irradiation, are the following facts, based upon the experimental evidence just reviewed:

1. Very few experiments have been performed, and some of these have not been well controlled.

2. Injury of offspring has not always followed maternal irradiation in control experiments.

Furthermore, it is quite possible that the human ovary and the animal ovary may not respond alike to irradiation. The human ovum may be so sensitive to irradiation that dosages large enough to bring about the desired therapeutic results will in all cases kill the more mature ova, whereas the primordial follicles may be so resistant as to withstand completely any injury that may result from such substerilizing irradiation dosage.

From our review of the experimental evidence adduced we have drawn the following conclusions:

1. *Irradiation of the developing embryo* is extremely likely to injure its health and future development.

2. Pre-fertilization ovarian irradiation of animals *may* injure the health of subsequent offspring.

3. Additional confirmatory experimental evidence would be of great value in determining what effect preconception or pre-fertilization irradiation really has upon the health and development of future offspring.

4. The health and development of all children born of mothers who have received pelvic irradiation during or prior to the pregnancies concerned should be studied carefully, in order to ascertain whether such maternal irradiation has had any harmful results upon the health of the children.

OBSERVATIONS ON HUMAN BEINGS

A study of the current literature has been made in order to gather as much information as possible concerning the health of all children whose mothers received pelvic radium treatment or X-ray irradiation during or before pregnancy. Approximately 320 such pregnancies have been reported. Few observers have published more than one or possibly two personal observations on cases associated with irradiation given during or preceding pregnancy. Where other authors' cases have been quoted, original sources have, whenever possible, been examined and an attempt has been made to secure all available data bearing upon the health of children born of irradiated mothers, following such treatment, regardless of the time that had elapsed between the treatment and the conception. In a few instances there were twin births. In eleven cases second children were born following one radium treatment or X-ray pelvic therapeutic irradiation, and of these eleven women, four conceived the third time.

The large number of pregnancies recorded in this investigation are explained by the fact that a group of forty-nine pregnancies were reported by Pinard (129), with practically no details of the treatment. It is quite possible that if such details had been included, many of these pregnancies might have been omitted as unsuitable for this study, and the grand total have been thereby reduced. There were 113 reports examined. The first report was made in 1906, and from that time until 1920 relatively few cases were recorded. In 1920 there was a decided increase in the number of observations, and since then the number of investigations recorded each year has been fairly constant.

Lack of space prevents the publication of the abstracts of the case reports from which our material was drawn. The references (42–156) in the bibliography, however, give the sources from which this material was secured. To the best of our knowledge, it includes all reports of pregnancies associated with irradiation in which details bearing upon the health of the children or of the fetuses concerned were found. Therapeutic abortions, performed by means of X-ray irradiation, in which no description of the development or health of the fetus was included were omitted from this consideration. It was believed that such cases would be of no value in this study, since the health or development of the child thus born was the chief point of interest. On the other hand, cases in which accidental abortions occurred, although no mention was made of the health of the fetus, were included, in order that we might learn the effect of irradiation upon the abortion rate.

The ages of the women receiving irradiation were mentioned 122 times. The youngest woman treated was 18 and the oldest was 46 years of age. Figure 3 is a polygonal curve, indicating the number of treatments given, arranged according to the ages of the women treated. According to Norris (121), the peak of the curve, between the ages of 27 and 34, represents the period of greatest fertility.

Meager data bearing upon the health of children born prior to irradiation treatments were found, but in a large number of cases mention was made of the frequency of abortion. For this reason a study of the health of children born prior to irradiation has necessarily been omitted, whereas a study of the abortion rates as influenced by irradiation has been made possible.

Abortion rate in general population. Since registration of pregnancies and abortions is not required in most communities, it is diffi-

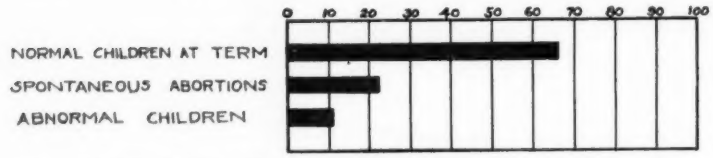

Fig. 4. Health of human offspring following maternal pelvic irradiation. Showing the relative frequency of abortions and abnormal children in a series of 320 pregnancies, associated with therapeutic pelvic maternal irradiation, given either before or after the parent became pregnant.

cult to determine the true abortion rate for the general population. Through the kindness of Dr. J. B. De Lee, however, Table 1 is presented, which indicates the frequency of abortion in the cities cited.

Abortion rate in women receiving irradiation. From Figure 4 it will be seen that the frequency of spontaneous abortions recorded here is about 22 per cent. This applies to the 320 pregnancies observed, regardless of the time of irradiation treatment as respects the onset of conception. This rate appears to be even lower than the normal rate, as may be observed from Table I.

TABLE I.—ABORTION RATE FOR GENERAL POPULATION IN GERMAN CITIES CITED BELOW

Author	Date of observation	Place	Abortion rate per cent
Latzko	1898	Vienna	18.9
Latzko	1908	Vienna	32.7
Latzko	1913	Vienna	57.2
Bumm	1917	Berlin	20.4
Hirsch, M		Berlin	30.0
Schottelius	1919	Hamburg	50.0
v. Jaschke	1920		25.0
		Average	33.4

TABLE II.—ABORTION FREQUENCY IN MULTIPARÆ AS INFLUENCED BY IRRADIATION

		Number
Irradiated multiparæ		61
Pregnancies in these women prior to irradiation		256
Abortions in these pregnancies	(18%)	47
Pregnancies in these women after irradiation		73
Abortions in these subsequent pregnancies	(19%)	14

In this table the abortions occurring after irradiation are recorded irrespective of whether the treatment took place before conception or after the patient became pregnant.

Abortion rate in women before and after irradiation. Data are presented in Table II, showing the frequency of abortion in irradiated women, as it occurred both before and after the irradiation treatment. This material is presented graphically in Figure 5. These percentages of 18 and 19 indicate that the irradiation has had very little effect upon the abortion rate, and in spite of the fact that the patients so treated were in most instances suffering from disturbances of the generative organs, which might be regarded as favorable to a high abortion rate.

Abortion rate in first, second, and third pregnancies following irradiation. Eleven women after irradiation had second children, and of these, four had third children. It is interesting to note that in this group all the children born at term were perfectly normal. The abortion rate for the first eleven pregnancies in this series appeared to be identical with the rate for the second eleven pregnancies, there being four abortions in each group of eleven pregnancies. In the third pregnancies there were two abortions and two full-term healthy children. This abortion rate is graphically presented in Figure 6.

Abortion as influenced by the time of the irradiation, with regard to the date of fertilization. Fifty-three women were irradiated at some period during pregnancy, and nine aborted (16.9), whereas 265 women were irradiated before the beginning of pregnancy, with 67 abortions, or a rate of approximately 26 per cent. These percentages are shown graphically in Figure 7.

Indications for irradiation. The indication for treatment was mentioned 177 times. In approximately 70 per cent of the women in this series of 177 cases, pelvic disease was the indication for the treatment. The most important symptom was uterine hæmorrhage, usually the result of ovarian dysfunction. The second most important indication for irradiation was myoma uteri, and the third most frequent was carcinoma of the cervix

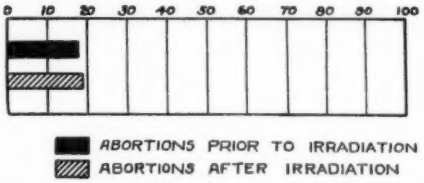

Fig. 5. Abortion rate as affected by irradiation. Showing the relative abortion rates in 256 pregnancies occurring in 61 women before irradiation, and the same kind of a study in these women after pelvic irradiation, where 73 pregnancies occurred.

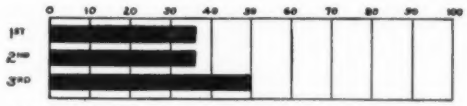

Fig. 6. Abortion rates in first, second and third pregnancies following single maternal pelvic irradiation exposures. Showing the abortion frequency in eleven women, following maternal irradiation. All had second pregnancies while four had third pregnancies. Note the uniformity of the rate in the first two pregnancies of these eleven women.

uteri. Other indications included various pelvic disturbances, and some diseases of a more general nature, such as cardiac complaints, leukæmia, psychoses, and the like, where future childbearing was deemed inadvisable. In these cases the pregnancy occurred in spite of the irradiation, given to induce permanent sterility.

Sources of radiant energy. In this series of pregnancies subjected to pelvic irradiation, the X-ray seemed to be the method most often applied, having been definitely mentioned as being the agent employed in 108 cases, whereas radium was used in 64 cases; in one or two instances a combination of both agents was employed.

Irradiation dosage. The exact dosages of X-ray and radium as applied in this series of 320 pregnancies were not recorded. This was due to a variety of reasons: In the first place, in quite a number of instances no definite mention was made as to whether either radium or the X-ray was employed, the word irradiation alone being used. However, it may be assumed that the X-ray was used in most of these cases. In another large series of cases no mention was made of the dosage employed. In still other reports all details were not recorded, and when the treatment was described, the technique employed seemed to vary so much in the different cases that it was impossible to secure uniform data for analytic purposes. For these reasons no systematic attempt was made to collect information concerning the dosage. The chief criterion as to dosage in selecting these cases for study was, first, that a therapeutic dosage had been used, in distinction to a diagnostic dosage, as in the case of X-ray; that it had been applied in such a manner that in all probability, the ovaries received a large share of the irradiation, and that pregnancy was known to exist at the time of treatment or to have followed at a later date.

Effects of irradiation upon human offspring. In considering the effects of irradiation upon offspring, the bearing that such treatment may have upon the abortion rate has previously been discussed, and we have seen that it apparently has little, if any, effect in increasing or decreasing this rate. From the practical point of view, the most important question for elucidation is whether maternal irradiation does injure the health of offspring who reach the period of viability, are born at or near term, and possess such vitality as to become personalities in the true sense of the word.

Figure 4 shows that, irrespective of the time at which the irradiation is given, as regards the onset of pregnancy, approximately two-thirds of the pregnancies and subsequent children are normal in every respect. Some 22, or 3 per cent, of the total number of pregnancies ended in abortion, and in the final 11 per cent the offspring, when born at or near term, appeared to be defective in some respect.

In selecting the individuals to be included in this last 11 per cent, all children who were born at or close to term were considered; also those who presented even slight defects, or serious defects, or who manifested some evidence, before the last observation was made, that their health was not perfect; also those who died early in life. The duration of time after birth that these children were observed varied greatly. In some, only the condition at birth was recorded, whereas in others, observations were made as long as 7 years after birth. All children *showing any disturbance*

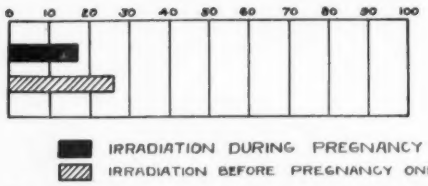

Fig. 7. Abortion rate as influenced by time of irradiation. Showing the abortion rate in fifty-three pregnancies, when the pregnant woman was treated, as compared with the abortion rate in 265 pregnancies, where the treatment was received before the beginning of pregnancy.

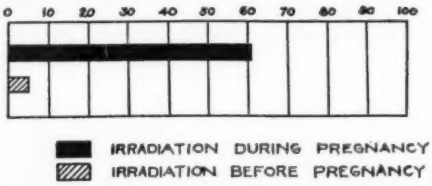

Fig. 8. Child health as influenced by the time of the maternal irradiation. Showing the relative frequency of disturbances in the health or development of children born at or near term, of mothers receiving pelvic therapeutic radium or X-ray irradiation, either when pregnant or at some time before the beginning of pregnancy.

whatever were included in this group, in order that the reader might appreciate the nature and the seriousness of the abnormalities recorded, even though these disturbances of health might not have had even a suspicious connection with the previous maternal treatment.

In the case of the animal experiments previously recorded, it was apparent that the frequency of birth of defective offspring was far greater in the group where the fertilized egg was irradiated than when the irradiation preceded fertilization or conception.

In analyzing the frequency of *defective human offspring*, according to this same time factor, the end-results have been summarized in Tables III and IV, and are graphically presented in Figure 8. It will be seen at once that, in the human, irradiation during pregnancy gives a high frequency of damaged offspring, whereas pre-pregnancy irradiation gives an extremely low percentage of damaged offspring.

TABLE III.—HEALTH OF CHILDREN FOLLOWING MATERNAL IRRADIATION DURING PREGNANCY

		Number
Women receiving irradiation at some period during pregnancy		53
Abortions in these pregnancies		9
Full term pregnancies	(100%)	44
Full term children not perfectly normal in every respect	(61%)	27

TABLE IV.—HEALTH OF CHILDREN FOLLOWING MATERNAL PRECONCEPTION IRRADIATION

		Number
Irradiation given before onset of pregnancy		265
Abortions in this series of cases		67
Full term pregnancies in this group	(100%)	198
Abnormal children born at term	(5%)	10

The question then arises as to whether in either or in both of these groups the offspring are damaged as the result of maternal irradiation or whether the defect is caused by some other agent. A more detailed study of the defects observed will help to clear up these points.

Nature of damage in children born of mothers irradiated during pregnancy. In the 320 pregnancies associated with pelvic irradiation treatment, 53 developing embryos were irradiated while *in utero*. Of the children born in this group, 27 were abnormal at birth. The majority presented serious developmental disturbances. The following is a list of the chief pathological findings, together with the names of the authors quoted:

1. deCourmelles in 1913 (77) reported the case of a small child, said to be underweight, which died a few hours after birth. Family history of lues. (X-ray.)
2. Ashenheim in 1920 (45) reported the case of a microcephalic child. (X-ray.)
3. Botarro and Bengoa in 1920 (54) reported a death in 10 hours, following cæsarean operation. The child was premature, and was not properly taken care of during first night after birth. (Radium.)
4. Albrecht (43) quoted by Flatau (1920) reported a microcephaly. (X-ray.)
5. Berkeley (101) quoted by Lawson (1921) reported a bald spot on a child's head following intracervical radium treatment; the spot later disappeared. (Radium.)
6. Flatau in 1921 (75) reported a microcephaly. (X-ray.)
7. Stettner in 1921 (144) reported a microcephaly. (X-ray.)
8. E. Zweifel in 1921 (156) reported the case of a small well developed child. (X-ray.)
9. Apert and Kermorgant in 1923 (44) reported a microcephaly. (X-ray.)
10. Bailey and Bagg in 1923 (47) reported a death in 15 days. The child had a spina bifida and double club feet. (Radium.)
11. Bailey and Bagg in 1923 (47) reported a death from pneumonia at 2½ months. Cæsarean section was complicated by eclampsia. (Radium.)

12. Bailey and Bagg in 1923 (47) also reported a death in 11 hours. The child showed malformation of the head, with sagittal suture open. (X-ray.)

13. H. Little in 1923 (104) reported a microcephaly. (Radium.)

14. G. Petenyi in 1923 (126) reported a microcephaly. (X-ray.)

15. Schiffer in 1923 (126) reported a microcephaly. (X-ray.)

16. Vignes and Cornil in 1923 (148) reported a case of acerebri.[1] A uterine sound had been passed 4 months before delivery.

17. H. Abels in 1924 (42) reported a microcephaly. (X-ray.)

18. LeLorier and Delapachier in 1924 (102) reported a slight nystagmus the second day after birth. (X-ray.)

19. H. Naujoks in 1924 (119) reported a microcephaly. (X-ray.)

20. N. Schilling in 1924 (138) reported a death in 3 hours after cæsarean operation for rigid cervix. (Radium.)

21. A. Schwaab in 1924 (137) reported a microcephaly. (X-ray.)

22. Ganzoni and Widmer in 1925 (81) reported a microcephaly. (X-ray.)

23. J. D. Lawson in 1925 (101) reported the case of a child below normal mentally and physically. (X-ray.)

24. Moeller in 1925 (114) reported a case of hydrocephalus and mongolism. (Radium.)

25. J. Zappert in 1925 (155) reported a weak, mongoloid imbecile with hypophalangia. (X-ray.)

26. E. Deutsch in 1926 (64) reported a microcephaly. (X-ray.)

27. P. Werner in 1926 (151) reported a microcephaly. (X-ray.)

Of the 53 women irradiated during pregnancy, 9 (16.9 per cent) had unhealthy children at or near term, or who died shortly after birth. In a few instances the disturbances of health noted might have been attributed to agents other than the previous maternal irradiation. In deCourmelles' case the death might easily have been due to the familial lues. Botarro's child apparently died because of prematurity and lack of care. The bald spot on the head of the child described by Berkeley was only an insignificant defect, although in all probability it was due to the intracervical radium application. The small size of the child described by Zweifel might have borne no relationship to the maternal irradiation. The child reported by Bailey and Bagg, dying at 2½ months, and whose mother had suffered from eclampsia, might also be eliminated from serious consideration. LeLorier's case, presenting a slight nystagmus on the second day after birth, could also be omitted from discussion here. Shilling's infant death following a cæsarean operation for rigid cervix is also a doubtful case, and may be omitted from our list. If these children are eliminated from our consideration, there still remains a large series of serious developmental defects to explain, and this selected group, including 14 microcephalic children, would seem to indicate that the maternal irradiation must have been the exciting agent in their production. From this résumé it may safely be stated that *irradiation of pregnant women*, when the pelvic organs are in the field of exposure, *is an extremely dangerous procedure, affecting, as it does, the health of the child in utero.*

[1]Absence of brain matter, traumatic, due to craniotomy followed by extraction, by means of a cranioclast.

Health of children born following preconception pelvic irradiation. In this group, to begin with, we find a relatively small number of children born at or near term in whom there is any marked degree of impairment of health or any developmental defects. Nevertheless, one cannot say definitely that this group is perfectly normal, nor that the defects present are of only a mild nature. A brief list of the chief defects observed follows:

1. R. Koehler in 1918 (95) reported a death in 2 days from pneumonia. (X-ray.)

2. F. Heimann in 1920 (87) reported the case of a pale, but organically normal child, of good intelligence, but who did not talk much. The child walked at 17 months. Author believed the trouble to be due to prematurity and the lateness in life at which this pregnancy occurred. (X-ray.)

3. O. Pankow in 1920 (125) reported the case of a child weak at birth and pale; who could not sit at 9 months and who later had rickets and otitis media. (X-ray.)

4. L. J. Stacy in 1920 (143) reported the case of a premature child, deformed but no description of the deformity was given. (Radium.)

5. A. Peralta Ramos in 1924 (128) reported the case of a child who was small; whose skin was dry, wrinkled, and icteric; who had two ossification defects in the left parietal bone, and one in the right parietal bone. Erythrodermia appeared a few days after birth. Treatment was given only 1 month before conception took place. (X-ray.)

6. F. A. Pemberton in 1924 (127) reported the death in 2 days of a 7½ months' fetus. Mother had eclampsia. (Radium.)

7. H. Behrendt in 1925 (50) reported the case of a slightly underweight, but normally developed child. Mother had heart trouble and severe anæmia. (X-ray.)

8. Gummert in 1925 (82) reported a microcephaly. Treatment of mother was given several years prior to birth of this child. (X-ray.)

9. E. Ries in 1926 (131) reported the stillbirth of a hypocephalic child with no right forearm; no right thumb; calvarium bones thin; cæcum to left, distended, etc.; mother an idiot. (X-ray.)

10. D. P. Murphy in 1927 (117) reported the death of a well-formed child following a three-day labor and cæsarean section. Case irradiated by author, but delivered by another physician. (Radium.)

In studying this group of 10 children born of mothers who received their irradiation prior to the beginning of pregnancy (there being 265 women in this group), it is evident that, in a number of instances the disturbances might, with justice, be attributed to causes other than the preconception irradiation. In this group there seemed to be no uniformity of defect, as was observed in the group in which irradiation was administered during pregnancy.

Of the 10 cases listed in this preconception group, 6 could be attributed to other possible causes, such as the following: Case 2, prematurity and the lateness in life of the pregnancy; Case 5, child possibly syphilitic (author's view); Case 6, maternal eclampsia; Case 7, severe maternal anæmia and cardiac disease; Case 9, mother believed to be almost an idiot. Defects in children born of these mothers are more frequent than in those of normal individuals; Case 10, death due entirely to difficulties of birth (author's case).

If these 6 cases can be considered as presenting disturbances, or death, due to factors other than the preconception maternal pelvic irradiation, only 4 children in some 265 births may be regarded as having possibly received any injury as the result of the previous maternal irradiation. These four children presented: Case 1, death on the second day after birth; Case 3, general weakness and a tendency toward disease; Case 4, a deformity the nature of which was not disclosed; Case 8, an apparently true case of microcephaly.

General Discussion

From the evidence at hand, it does not seem necessary to discuss the question as to whether irradiation of the pregnant woman injures the health of the child, when such treatment is administered while the fetus is *in utero*. That damage results is fully confirmed by the great bulk of experimental work upon this subject. This indicates that serious developmental disturbances are likely to result from such treatment in human beings, at least when the exposures are given in what are commonly accepted as therapeutic dosages.

Concerning the effect, upon the health of future children, of irradiation when applied to the ovarian region *before pregnancy has taken place*, no definite answer can be given. The animal experimental work indicates that damage to subsequent children is likely to result. This evidence is not yet, however, considered to be sufficient upon which to base a final satisfactory conclusion. A full discussion of clinical observations made upon women who have received such irradiation is necessary in order to help clarify this problem.

The number of preconception radium and X-ray treatments (265 approximately) recorded in the literature, with their associated births at or close to term, including only 10 cases in which the children born at that time were not normal, do not present any very striking indication that the previous maternal irradiation had any definite or serious effect upon the health of the children born following such treatments.

The frequency of neo-natal morbidity and mortality in the population at large is difficult to estimate, and especially so in the maternity or pediatric wards of hospitals, since the statistics gleaned from these institutions are influenced abnormally by the great selectivity necessarily practiced.

The wide variety of disturbances observed in the 10 children born of mothers (265) irradiated in the pelvic region prior to conception, and the relatively small number of these children, are both opposed to the belief that the irradiation was the cause of the disturbances. Furthermore, these 265 women constituted a very highly selected group, selected in most instances because of their pelvic disease. As we do not know just what relationship might exist between pelvic diseases and the health of children born of these mothers, and as it is practically impossible to secure a suitable control group of women who have had pelvic disease, and children, without any irradiation treatment, it is impossible to state definitely just what relationship there may be between irradiation treatments and the health of these children, in view of the existence of the maternal pelvic disease.

Furthermore, we have practically no knowledge concerning the heredity of these children,

to say nothing of the possibilities of syphilis, alcoholism, tuberculosis, etc., and the effect they may exert through the parental blood stream.

There is one case in this group of children that presents gross abnormality following preconception maternal irradiation; this suggests that the irradiation might possibly have had some influence in bringing about the defect, and that is, the microcephalic child described by Gummert. This child presents the single connecting link with the group of children who received irradiation *in utero*. It appears to be the only abnormality that suggests any relationship between maternal irradiation and injury to the health of subsequent offspring, in cases in which the treatment preceded the onset of the pregnancy concerned. According to Gummert, this pregnancy took place some 2½ years after the maternal irradiation. It would seem extremely unlikely that an ovum would be partially damaged, live for 2½ years, and become fertilized. As a possibility, however, it cannot be denied. If we study the frequency of microcephaly in the population as a whole, we have an additional reason for believing that this case was probably not caused by the preceding maternal irradiation. According to Storrs, of the Letchworth Village Colony for Feeble-minded Children in New York State, the frequency of microcephaly in the population at large is probably not more than one in ten thousand or more births. If we go still farther, it would seem that one case in 265 births would be a somewhat high rate of frequency of microcephaly, and that it would be quite possible in this case for the irradiation to have been the cause of the disturbance. Considered theoretically, as regards the frequency of microcephaly in this group, we might assume that, if we had been able to study a group of some 20,000 irradiated women, we might not have found another similar case.

Without going into further detail concerning the frequency and nature of the disturbances observed in the children born at or close to term, following maternal preconception pelvic irradiation, we feel reasonably sure, from the evidence at hand, that the preconception irradiation was not the cause of the disturbances cited, but we cannot make this statement with absolute certainty.

GENERAL SUMMARY

1. The literature bearing upon ovarian irradiation as it may affect the health of subsequent offspring, both animal and human, has been carefully reviewed.

2. Frequent serious developmental disturbances have been observed in animal and human offspring, when the pregnant animal or human, or the fertilized egg has been directly irradiated. These disturbances are severe in nature, and in human beings present themselves most frequently in the form of arrested cerebral development, characterized by the condition known as microcephaly.

3. Abnormalities of development and structure have been observed in the young of animals that were irradiated prior to conception or fertilization.

4. Children born of women who have been irradiated in the pelvic region prior to conception also present abnormalities of development and disturbances of health, early death and other abnormal conditions.

5. These abnormal conditions are not especially frequent, nor are they uniform in character.

CONCLUSIONS

1. Irradiation of pregnant animals or human beings is a procedure extremely dangerous to the health of the offspring concerned (61.3 per cent defective), and in the case of human beings ought not be undertaken unless such existing pregnancies are to be terminated artificially prior to the period of viability of the child.

2. As yet, it cannot definitely be stated that preconception maternal pelvic radium or X-ray irradiation is or is not prejudicial to the health of subsequent children.

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WHAT EVERY DOCTOR SHOULD KNOW ABOUT CANCER OF THE STOMACH AND WHAT A GASTRO-INTESTINAL STUDY MEANS

By JOSEPH COLT BLOODGOOD, M.D., F.A.C.S., Baltimore, Maryland

IN 1915 I made a complete survey of all the records of the so-called "stomach cases" recorded in the medical and surgical departments of the Johns Hopkins Hospital and of the many other records of resected specimens which had been sent to the surgical pathological laboratory by my colleagues.

Even before the advent of the X-ray there seems to have been no difficulty in diagnosing cancer of the stomach. The medical service under Doctors Osler, Thayer, and McRae never failed to refer to Dr. Halsted's service all the organic lesions of the stomach first admitted to the medical clinic. Practically every patient with cancer of the stomach admitted to the medical clinic either died while on the surgical service or was discharged from that service. Even more important, when we wrote to the patients with stomach complaints who had been on the medical service only and in whose case in each instance a diagnosis of non-malignant lesion had been made, we were unable to find that cancer of the stomach had later been found.

Of the cases of cancer of the stomach studied up to 1915, representing the first 26 years of the Johns Hopkins Hospital, 75 per cent were inoperable and among the 25 per cent in which the cancer could be completely resected, there was, among the Johns Hopkins group one 5 year cure. In this case the stomach was resected by Doctor Miller who was then resident surgeon. The patient lived 9 years and died in the Johns Hopkins Hospital of cancer of the cervix. An autopsy proved that there was no recurrence of cancer in the region of the stomach, and the cervical cancer was not metastatic. From all sources in 1913, there were but three 5 year cures. In the second cured case I resected the stomach at St. Agnes Hospital, in 1908. This patient lived until 1926, 18 years, and died of other causes. The late Doctor Hertwig, of Buffalo, New York, sent me the resected specimen of a cancer of the stomach, from a patient who lived 8 years after operation and then died of malignant disease of the kidney. These three cases of cancer of the pyloric end of the stomach answered Kocher's rule which was: cures could be accomplished and, in his experience, accomplished only in freely movable tumors of the pylorus which produced obstruction early.

When we read and carded the histories of cancer of the stomach in 1915, we could easily see, from the written records, that all of these patients had suffered from indigestion and had been sufficiently ill to demand an examination long before they did so—in some instances the patient being ill on an average of more than a year.

This study has shown the remarkable contrast between the education of the doctor, with his great skill and precise instruments, on the one hand, and the lack of education of the people, on the other. It was quite apparent that the failure to educate the people had rendered all the wonderful education of the medical profession and surgical skill illusory. We had anæsthesia. Surgical technique had been developed far beyond the dream of Pasteur. Billroth had conceived and executed his resection of the stomach and the anastomosis known as Billroth I—duodenogastrostomy end-to-end—Billroth II—closure of the resected ends of duodenum and stomach, and a gastro-enterostomy of some type. During this period, 1890 to 1915, the mortality of resection for cancer of the stomach was relatively small throughout the world. The failure to cure cancer of the stomach could be explained only by the ignorance of the adult laymen; their failure to realize the possible danger of "indigestion."

I restudied the material again in 1926, and wrote the chapter on "Cancer of the Stomach" for the system of surgery which is edited by my colleague, Dr. Dean Lewis. Twelve years had passed. Diagnosis by the

Fig. 1. Case 1. Pathol. No. 38634. The filling defect 10 minutes after bismuth by mouth.

Fig. 2. Case 1. Pathol. No. 38634. The filling defect 1 hour after bismuth by mouth. Compare with Figure 1.

X-rays had improved tremendously. The mortality of resection had been reduced to a minimum. In spite of all this, cancer of the stomach is admitted to the surgical clinics of the world with an inoperability of more than 50 per cent, and, when resection is possible, with a curability of less than 35 per cent. It is quite true that every surgeon is resecting cancer of the stomach in its earlier stages and every now and then he resects a benign tumor of the type that precedes cancer, but these are the exceptions not the rule. The rule is still inoperability in far too many cases, for when the patients are examined with the X-rays and referred to surgery, the condition has passed beyond the benign stage.

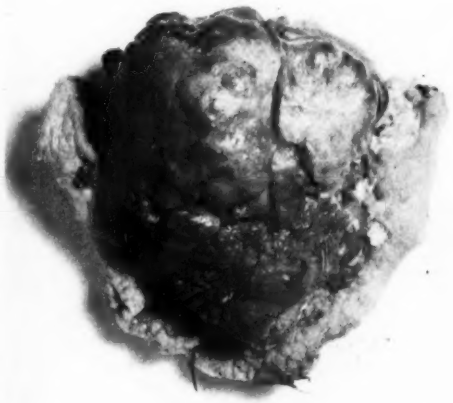


Fig. 3. Case 1. Pathol. No. 38634. Photograph of the surface of the polypoid tumor with the resected zone of normal stomach wall. For filling defect see Figures 1 and 2.

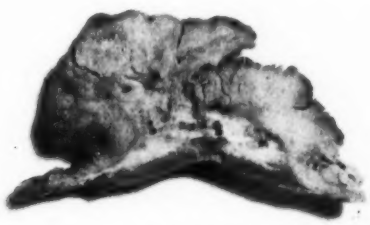


Fig. 4. Case 1. Pathol. No. 38634. Gross section through tumor shown in Figure 3. Note the normal peritoneum, muscular coats, and submucosa. The tumor is like a benign wart, simply a hypertrophy of the mucous membrane.

Fig. 5. Case 1. Pathol. No. 38634. Photomicrograph (low power) of polypoid tumor shown in Figure 4, a benign adenoma, simply a hypertrophy of the glands in the mucous membrane of the wall of the stomach.

Fig. 6. Case 2. Pathol. No. 39822. The filling defect on the lesser curvature 10 minutes after bismuth by mouth. The tumor proved to be a carcinoma.

Every member of the medical profession should know that cancer of the stomach, especially on the pyloric half, belongs to the curable type of cancer, and its complete removal is not a dangerous operative procedure, but doctors of medicine must also know that the X-rays, both in fluoroscope and film, are the only instruments of precision that will make the diagnosis possible—and diagnosis accurate—of all organic lesions of the stomach wall.

What we have to do is to teach the public to seek examination the moment they are warned of indigestion and to teach the doctor that it is really more important to study the stomach with the X-ray than the heart with the stethoscope.

I have very carefully investigated the cases which I have studied personally, cases which presented lesions within the abdomen with symptoms sufficient to justify a study of the stomach with the fluoroscope and films, and I have been unable to find a single case in which we have overlooked a cancer of the stomach. If an ulcer or cancer in the wall of the stomach, or a papilloma, or any type of benign tumor of the wall of the stomach is present it will produce a filling defect which is easily recognized in the fluoroscope and pictured in the film, and this filling defect on the pyloric side of the stomach, to the left of the pylorus, is a positive indication for exploration.

Inoperable cancer of the stomach. My experience also teaches me that it is dangerous to conclude through X-ray examination only that any lesion of the stomach is cancer and inoperable. The positive signs of hopeless cancer of the stomach are: peritoneal exudate, skin nodules in the abdominal wall, or enlarged nodule of the liver.

Again and again, when the X-ray examination has indicated inoperability, I have been able to resect the cancerous mass.

Exploratory laparotomy. One can explore the stomach under local anæsthesia by an incision in the mid-line below the ensiform, and it is my opinion that this should be done in all cases except when the malignant disease is clinically hopeless. Secondary anæmia

Fig. 7. Case 2. Pathol. No. 39822. Photograph of peritoneal surface of sleeve-resected portion of the middle third of the stomach. The cancer about to perforate is seen at *X*.

Fig. 8. Case 2. Pathol. No. 39822. Photograph of the fungous tumor of the inner side showing the amount of stomach wall resected. The narrower portion, longitudinal, of the stomach wall shows a smaller margin of uninvolved stomach due to contraction from the formalin. Compare the surface of the malignant fungus in Figure 8 with the benign polypoid tumor in Figure 3.

should not be a contra-indication, because we may institute blood transfusion.

What is a complete gastro-intestinal study? First, an X-ray examination of the abdomen to look for stones in the gall bladder, kidney, and ureter. I always combine this with an X-ray examination of the chest. Then the patient can be given bismuth for an immediate fluoroscopic examination and a series of stomach films may be taken. The next day it is possible to examine the stomach a second time through the fluoroscope and films and to study the colon from the bismuth given the day before. In every instance, when the findings from examination of the stomach and colon are negative and there are no indications to open the abdomen, an X-ray study with a dye, should be made of the gall bladder. If one finds a distinct filling defect in the stomach or colon, the gall-bladder examination may be omitted.

If any intestinal symptom is present below the zone of the stomach or the stools show signs suggestive of disease of the colon, proctoscopic examination should never be neglected, and, if such examination is negative, an X-ray should be made after the colon is filled with a bismuth enema.

The proctoscope will not fail to reveal any lesion in the rectum as far as it is possible to see with it. An X-ray film made after a bismuth enema has been given will fail but on rare occasions to picture the filling defect of an organic lesion of the colon; lesions of the duodenum and stomach are always pictured. If the filling defect or irregularity of the bulb is on the duodenal side of the pylorus, we know that the defect is not cancer.

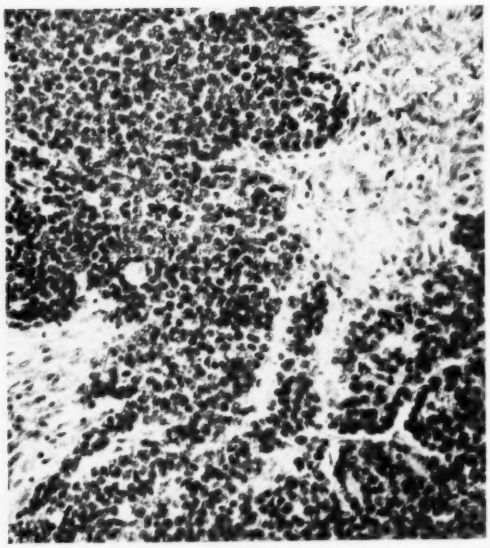


Fig. 9. Case 2. Pathol. No. 39822. Photomicrograph (low power) of tumor shown in Figure 8.

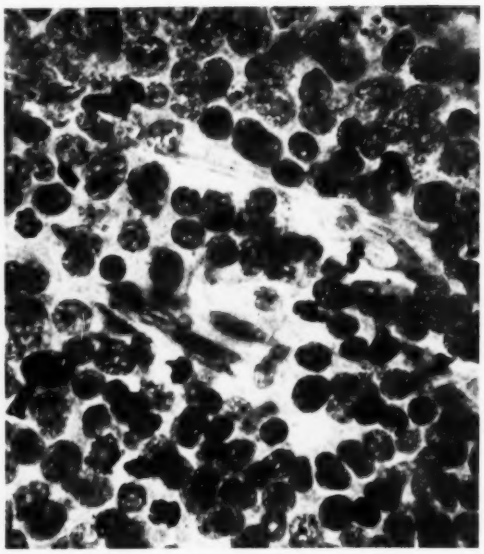


Fig. 10. Case 2. Path. No. 39822. High power photomicrograph of tumor shown in Figure 8. Compare the typical cancer cells, the picture of high grade malignancy with the cells in Figure 5, of the benign adenoma. Even if this tumor in Figure 5 were cancer, the morphology of the cells would be of a low grade malignancy. The patient died in about 6 weeks of metastasis to the liver.

The first thing to do is to get correct information to the public, and this is a difficult task. It is quite true that thousands of people today are coming under the observation of the medical profession for X-ray study, but with few exceptions such patients have suffered for months and years with chronic disease. If their trouble is cancer, it is too late. When a cancer of the stomach or colon has produced acute obstruction the patient has the best chance, because he is forced to go to the hospital. But acute obstruction is rarely an early occurrence in these cases.

I have purposely omitted reference to the examination of gastric contents, of fæces, to the use of the duodenal tube, and to other laboratory examination. Of course, they are part of a complete gastro-intestinal study. In this short note I am anxious to impress every doctor that it is the X-ray—the fluoroscope and film—which is the instrument of precision for the accurate and early detection of organic lesions of the wall of the stomach, duodenum, and colon, and that the X-ray picture made after the administration of the dye is now the most accurate method of telling whether or not the gall bladder empties itself.

An article entitled "The Survey of Stomach Carcinoma" was published in the *Journal of the American Medical Association* June 19, 1915.[1] The total number of cases reported was 183. The inoperability up to 1910 was 81 per cent; the inoperability in the next 5 years, to 1915, had decreased from 81 to 62 per cent. Quite recently Dr. William Mayo, giving the figures for his clinic for 1927, records inoperability of 50 per cent.

These figures justify the educational efforts of the American Society for the Control of Cancer, and in this paper it is my desire to bring the facts before the medical profession and to emphasize the importance of an immediate X-ray study of the stomach, no matter how slight the symptoms of indigestion are.

ILLUSTRATIVE CASES

CASE 1. Figures 1 to 5 picture the filling defect in the X-ray, the gross appearance of the benign polypus, and the microscopic section showing a benign adenoma.

[1] lxiv, p. 2031.

Fig. 11. Case 3. Pathol. No. 39150. Roentgenogram showing filling defect 15 minutes after bismuth by mouth. Diagnosed inoperable by most of the examining group. At exploratory incision easily operable tumor was found. Resection Billroth I. The patient is well, February, 1928, 10 months. For gross appearance see Figures 12 and 13.

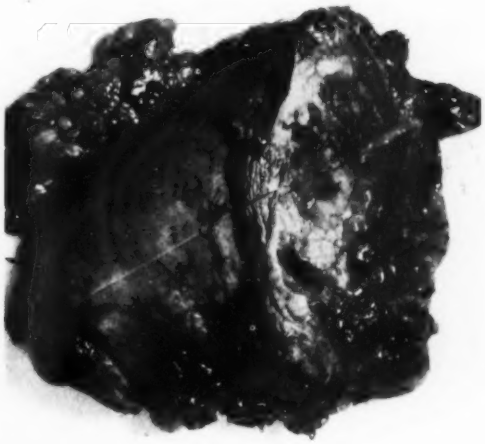


Fig. 12. Case 3. Pathol. No. 39150. Photograph of gross resected specimen. For X-ray see Figure 11. The fungous tumor is easily seen through the gastric end at the right of the picture. There is no perforation of the peritoneal coat by tumor tissue and there were no adhesions. For longitudinal section see Figure 13.

Clinical note. The clinical history, the laboratory examinations, and the X-ray study suggested a malignant tumor in the wall of the middle third of the stomach at the greater curvature. Yet, at the operation, a benign polypus was found and removed.

The patient claimed that his indigestion had been really bad for 3 months. I am convinced that 3 months ago, the symptoms justified an examination. He can still eat a big meal only to be followed by discomfort. Palpation of the abdomen fails to disclose a mass, but there is some muscle rigidity in the upper abdomen which prevents deep palpation, a condition not infrequent in gastric and pancreatic lesions. The stomach contents show absence of hydrochloric acid, low acidity (9), the presence of lactic acid, pus cells, blood cells (red), and bacilli. Examination also showed moderate secondary anæmia, no blood in the stools. This gastric analysis without residuum suggested cancer.

On questioning the patient again and again, he admits that he has had some slight indigestion for one year, since 59 years of age, but he explained this by the presence of recurrent root abscesses. With the intense discomfort after eating for 3 months there has been no vomiting, and he has lost only 5 pounds in weight.

At the operation, which was performed largely under local anæsthesia with light nitrous oxide and gas ether, we could see nothing wrong in the stomach, which was of good size, but on palpation in the middle third at the greater curvature, we could feel a tumor the size of a hen's egg, with a pedicle, about one-third of the diameter of the tumor.

The stomach was immediately opened, and, by sight and touch, no signs of malignant infiltration

Fig. 13. Case 3. Pathol. No. 39150. Photograph of longitudinal section of resected stomach shown in Figure 12. Note that there is no perforation of peritoneum, only slight infiltration of the muscular coat. For microscopic picture see Figure 14.

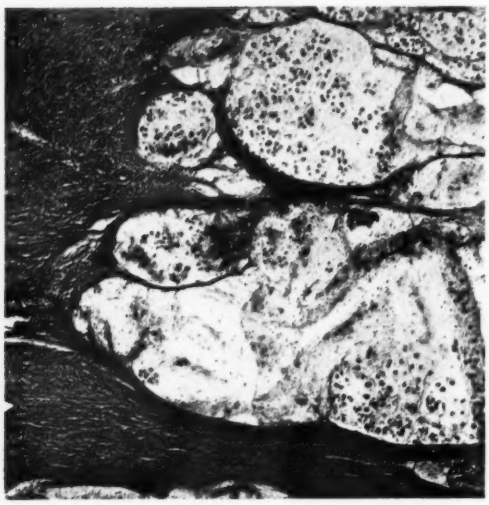


Fig. 14. Case 3. Pathol. No. 39150. Low power photomicrograph showing the relatively benign colloid cancer infiltrating into the muscular coat, taken from the tumor shown in Figure 13.

Fig. 15. Case 3. Pathol. No. 39150. Colloid cancer, high power photomicrograph, from area shown in Figure 14.

were discovered at the base. A wedge-shaped piece of the stomach wall both anterior and posterior was resected. The tumor projected from the posterior wall, and the defect was sutured end-to-end. A frozen section similar to that in Figure 5 demonstrated that we were dealing with a benign tumor, and a study of the stomach wall around the pedicle demonstrated that even if the tumor had been malignant it had been given sufficient margin. There was a second minute polypoid tumor which I removed without dividing the muscular and peritoneal coat.

The patient was not shocked by the operation and had no discomforts or complications of any kind. On the tenth day, however, he suddenly developed signs of embolic pneumonia without abdominal symptoms, and then in a few hours signs of embolism to the brain with rapid death. An autopsy was not allowed.

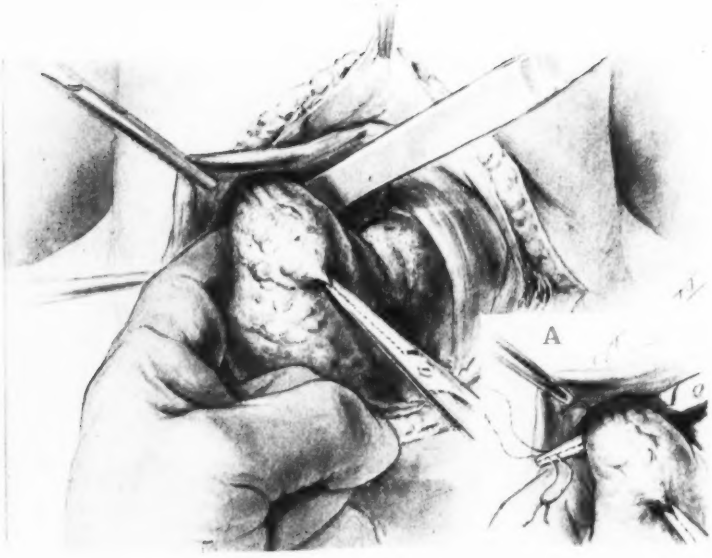
The most interesting point in Case 2 was that the tumor (Fig. 6) was just as operable as that in Case 1. Yet we knew at once, in the frozen section in Case 1, that the tumor was either a benign adenoma, or a possible adenocarcinoma of a low grade malignant, while from the frozen section in Case 2, we knew that we were dealing with a high-grade malignancy which up to the present time had not been cured by resection or any other means. When we compare Figures 5 and 10 with the microscopic sections of the three cured cases of cancer of the stomach which I reported in 1915, we will see a close resemblance with the picture in Figure 5—gross type adenocarcinoma, cells of low grade of malignancy. My studies of the grading of cancer of the stomach in which the patients have lived 5 years or longer after resection are not yet complete, but in not a single case do we find cells of the morphology shown in Figure 10.

Case 2. Patient was 68 years of age. Definite gastric symptoms were observed in March, but he did not come under the observation of a physician who made a complete X-ray study until November (Fig. 6 to 10). The operation was performed November 8. The tumor was so small and so movable, and the stomach so large that there was no difficulty in resecting the middle third and performing an end-to-end anastomosis of the two pieces of the stomach. The liver impressed me as unusually large, but I could see or palpate no metastatic tumor.

The patient recovered from the operation without complications. My former student and colleague Dr. Caldwell, of Evansville, Indiana, reported that the patient had no symptoms until about 6 weeks after operation, when he had sudden pain in the liver followed by death in 10 days. At the postmortem examination there was found a single huge necrotic cancer in the center of the liver. The sutured stomach was normal and uninvolved, and there had been no interference with gastric function.

Case 3 is selected for report here, because the X-ray film (Fig. 11) suggested to a number of experienced roentgenologists and surgeons that the condition was inoperable. Yet the tumor (Fig. 12) was easily removed with a good margin of healthy stomach and after its resection, a suture of the type of Billroth I, gastroduodenostomy, could be performed. Another remarkable feature is that this patient whose clinical symptoms and physical examination, palpation of the mass and X-ray studies all indicated inoperability, is apparently well today (February, 1928), 10 months after operation without a symptom of trouble, while Case 1, a benign tumor, had the misfortune to succumb to a rare and unpreventable postoperative complication. In Case 2 the small and operable cancer happened to be of a high grade of malignancy, and the patient died quickly of metastasis.

The section of the tumor in Case 3, which is shown in Figure 14, is of a lower grade of malignancy than that of Case 2 which is shown in Figure 10.



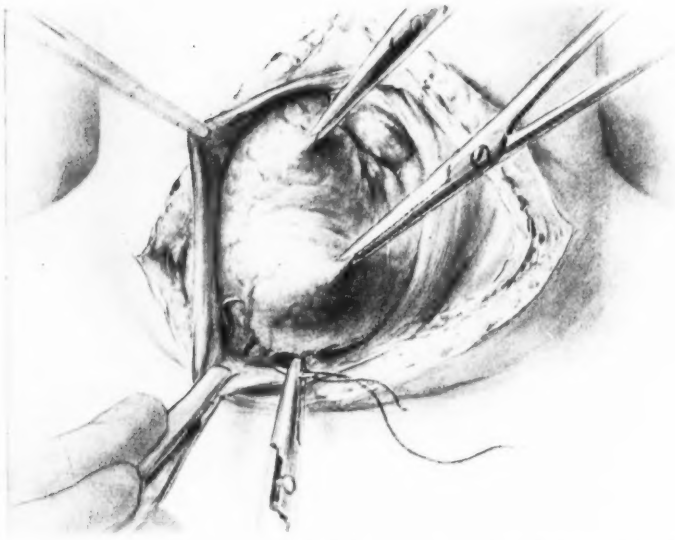


Fig. 8 (above). The upper pole is being coaxed out of its bed by means of the index finger and the handle of the knife aided by gentle traction of the forceps. The insert shows a Kelly forceps lifting the pole and grasping a double ligature.

Fig. 9. The gland is being gently elevated while a needle is being passed around the inferior thyroid veins. This ligature is tied but not cut.

Technique for Thyroidectomy—Arthur E. Hertzler.

CLINICAL SURGERY

FROM THE UNIVERSITY OF KANSAS, SURGICAL DEPARTMENT

TECHNIQUE FOR THYROIDECTOMY

BY ARTHUR E. HERTZLER, M.D., F.A.C.S., HALSTEAD, KANSAS

IN approaching the operation for the resection of a goiter, the surgeon must have two prominent factors in mind. First, the patient must be in proper condition for operation. If there has been a loss of weight, the patient must be gaining; must be taking food with a relish; and must present the proper mental attitude toward the operation. Second, enough of the gland must be removed to assure the patient of permanent relief from symptoms.

PRE-OPERATIVE PREPARATION

Toxic goiter patients are managed in the same way as other candidates for operation. When they enter the hospital, they are told that a period of rest will be required before they are ready for the operation but that they will be informed long enough beforehand so that their friends will have time enough to be present for the operation. The nontoxic patients are told that they will require no preparation and that the operation can be performed the following or any subsequent day. The toxic patients are told as nearly as possible what must be achieved before they are ready. If they have lost weight and have no appetite, they are told that they must rest until they have developed an appetite and have regained some of the lost weight. If they have lost weight and have regained some or all of the amount lost and are taking sufficient nourishment but have a rapid pulse, they are told that as soon as the pulse slows to 100 or less they will be ready. In a word, they are informed with perfect frankness in all regards. Everything that savors of the mysterious is carefully avoided. In my experience this is much more effective than trying to "steal" the gland. Most patients have friends who have undergone the operation, and if their glands have been "stolen," the new patient will know of it and will be constantly apprehensive as to the time of operation and each day will be one of anticipation. The surgeon must employ those qualities natural to himself to gain the patient's good will. If he has a sense of humor, he may "kid" his patient at times with advantage. It is fatal for him to essay a dramatic attitude when he is lacking in dramatic instinct. No one surgeon has a sense of humor and a dramatic instinct; they are the antithesis of each other. After all, it is the confidence the patient has in the surgeon that is the big factor. The next most important factor is the confidence, born of experience, that the surgeon has in himself.

Preliminary hypnotic. We are now using 1/6 grain of morphine given 2 hours before the operation and a like amount half an hour before the patient goes to the operating room. For slight and young patients this amount must be reduced. Pantopon in twice this amount is sometimes used. This drug is supposed to be less prone to be followed by nausea and vomiting than morphine but the advantage in this regard is very slight, if there is any at all. Atropine is not used because it causes flushing of the face and dryness of the mouth: the first worries the operator, and the second worries the patient. The use of scopolamine was discontinued long ago because some of the patients slept an alarmingly long time after the operation.

ANÆSTHESIA

Anæsthetic. Since all goiters, except those of children, are operated upon under local anæsthesia at the Halstead Clinic, this method alone will be considered. Novocain-epinephrin is always used. Since but a small amount of the drug is needed, there is no question of safety. The solution is made at the table. Three 2-grain tablets are taken directly from the commercial container, placed in a 2-ounce medicine glass, and rubbed up with the plunger of the syringe. An ounce and a half of boiled water is added and the solution of the powdered tablets is assured by agitating the water with the syringe. From 5 to 8 minims of epinephrin (1:1000) is removed from the bottle by means

Fig. 1. The line across the neck indicates the extent of endermic infiltration. The insert shows the direction the needle takes from the primary line of skin infiltration about the mesial border of the sternomastoid muscle. This blocks the anterior cervical nerves.

Fig. 2. The needle is being passed between the trachea and the upper pole of the thyroid gland. By pressing on the skin with the finger, one can make the point of the needle penetrate to any desired depth. Insert A: *a*, vagus nerve; *b*, internal branch; *c*, external branch of the superior laryngeal nerve; *d*, recurrent laryngeal nerve.

of a medicine dropper which has been boiled with the instruments. Neither novocain nor adrenalin is boiled. Such solutions have repeatedly been tested bacteriologically and found to be sterile. Novocain may be sterilized apparently without injury but epinephrin suffers deterioration by heating. A solution which shows the least tinge of color should be rejected. This method has been followed now for 15 years and no undue agitation from the effect of adrenalin has been observed. The advantage of this procedure is that the solution is sure to be fresh and, as it is prepared by one of the surgical assistants, the operator uses the solution with the full confidence that it has been properly made. No difference is made in the use of epinephrin in the various types of goiter. In highly toxic goiters, there may be a perceptible agitation while the solution is being injected, but this passes off in a few minutes, but even a slight reaction is unusual. Anæsthesia with novocain alone is not complete and does not last more than 15 minutes—not long enough even in the hands of an expert operator. The addition of the adrenalin increases the duration of the anæsthesia by 2 or 3 hours.

The advantages of local anæsthesia are many. A few of the more impressive ones may be mentioned. The operative field is made relatively bloodless. The important blood vessels are readily recognized and may be clamped before they are cut. The line of cleavage between the gland and its capsule can be followed by sharp dissection. If compression of the trachea is threatened, the gland can be so manipulated as to avoid it. If the recurrent nerve is irritated, a laryngeal reflex at once warns the operator. The ill effects of a general anæsthetic are avoided. Very important is the fact that the surgeon sees his patient on the table before anything has been done. If the patient is agitated, the operation can be deferred to another day. No patient that is fearful of the outcome of the operation should be operated on. Slightly agitated patients may be calmed by gentle assurance or by engaging them in irrelevant conversation. If these methods fail, the operation must be deferred. If, as happens in rare instances, the patient does not bear the operation well, only one lobe may be removed.

The most fatal thing to the success of local anæsthesia is to promise the patient that if necessary a general anæsthetic will be given. If this subject is broached, the patient must be categorically assured that local anæsthesia never fails. A surgeon who starts a local anæsthetic with a general anæsthetic in reserve is defeated before he starts.

Anæsthetization. The patient lies on a flat table with a small pillow under the neck and shoulders, and the occiput resting on the table. The pillow must not be high enough to cause the least embarrassment to respiration. In fat, short-necked patients the operator may be inconvenienced but the patient's comfort must be the first consideration. It is absolutely essential to make the patient comfortable. Skilled assistants will keep the ligatures from falling on unprepared areas. If the patient shows any disposition to cough, a nurse is in readiness to hold a towel over the face. However, the patient's face is not kept covered, as any covering would be uncomfortable and would hide from the operator the chief index as to the state of the patient. The operator should secure as comfortable a position as possible, preferably sitting on a high stool. The surgeons in our clinic do not wear masks but they do keep their mouths shut. With practice this can be done without pain. If any one feels the urge to make a speech, he is advised to reserve it for the staff meeting. Studies of culture media in the laboratory have convinced me that quiet breathing through the nose does not infect the environment but talking invariably does. Elaborate head dresses are uncomfortable to the operator and the strange appearance of the surgeon tends to agitate the patient.

Perfect instruments are essential. A simple, easily working syringe with a capacity of 5 cubic centimeters is used. The bore of the syringe should not be too large because the greater the diameter of the barrel the greater the pressure that must be applied to the piston and as the pressure increases the delicacy of the touch decreases. These items are of great importance for on the delicacy of touch depends the ability to determine the tissue into which the needle has penetrated. All accessory apparatus, such as pressure cylinders, self-filling syringes, special needles, and the like, are to be eschewed, because they are fatal to delicacy of touch and lead to the use of needlessly large amounts of solution. The needles should be as small as possible, and the points must be sharp and free from rust. For skin infiltration, a 26-gage needle, an inch long, is to be preferred and for the deeper infiltration, an 18-gage needle, 3 inches long, should be selected. Any one doubting the importance of fine needles and smoothly working syringes can convince himself of this fact by trying to infiltrate his own leg, or better still, have some unsympathetic associate do it. In my judgment, it is the huge syringes armed with needles the size of trocars so generally employed that bars the general use of local anæsthesia in thyroidectomies.

Fig. 3. The lines indicate the direction in which the needle is passed to infiltrate the ribbon muscles. Lines *2* to *8* pass over the surface of the gland; *1* and *9* pass over the lower pole. The insert shows the direction of the needle to reach the surface of the lower pole.

The infiltration of the anæsthetic. As an introduction the gland may be gently palpated to accustom the patient to the pressure of the operator's fingers. The initial prick of the needle is likely to try the patient's nerves more than any other step of the operation. Therefore, it is well to tell the patient that there will be a slight prick at the beginning. This first pain can be materially lessened by picking up a fold of the skin at the point where the initial puncture is to be made and by compressing it half a minute between the thumb and index finger cause an acute anæmia. The preliminary prick can be made with very little pain at the point of maximum compression. The initial wheal should be made slowly lest the sudden expansion of the tissue cause pain. A row of wheals

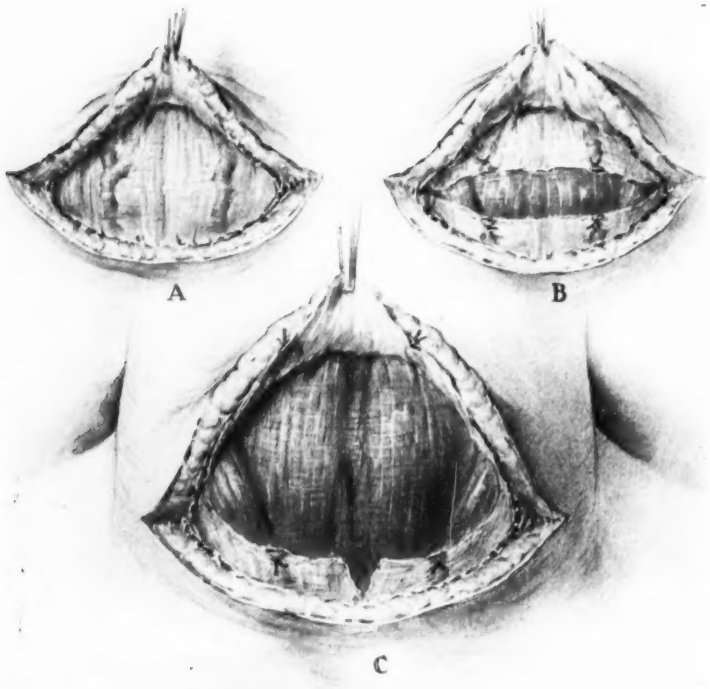


Fig. 4. Insert A shows the incision made through the skin, fat layer, and platysma muscle, exposing the fascia and the veins. B shows the fascia and veins severed and the latter ligated. C shows the fascia dissected free from the ribbon muscles. A notch is shown in the lower fascial flap.

is made along the line of the proposed incision (Fig. 1), this being usually along one of the natural folds of the skin or on a line where a string of beads would naturally fall (Bartlett). The injection must be made endermically, which is indicated by the prompt blanching of the skin. If the solution is injected below the skin, anæsthesia is not instantaneous and a needlessly large amount of fluid will be used. The entire extent of the proposed incision is infiltrated as the first step of the operation.

After the skin line has been infiltrated, the anterior cervical nerves are blocked at the point where they curve over the sternomastoid muscle. The needle is introduced in the anæsthetized line and passed along the medial border of that muscle and just above it (Fig. 1A). The needle is then passed more deeply to reach the ribbon muscles of the neck just beneath the sternomastoid. About 5 cubic centimeters are used in this step.

Without removing the needle the surgeon then infiltrates the region in front of the trachea in order to anæsthetize the region of the pyramidal lobe. This done, the needle is passed between the superior pole and the trachea. Pressure on the skin over the needle (Fig. 2) will make the needle dip into this space. This blocks the superior laryngeal nerves (Fig. 2A) and likewise œdematizes the tissue between the superior pole and the trachea, thus facilitating the delivery of the superior pole.

The left side is infiltrated in like manner.

The ribbon muscles over the goiter are now infiltrated. Entered in the line of the primary skin infiltration, the needle is passed into the muscles lying superficial to the gland. Care must be taken lest the needle pass too deeply, injure the superficial thyroid veins, and possibly cause infiltration of the tissue, making it more difficult to follow the line of cleavage. The extent of infiltration depends

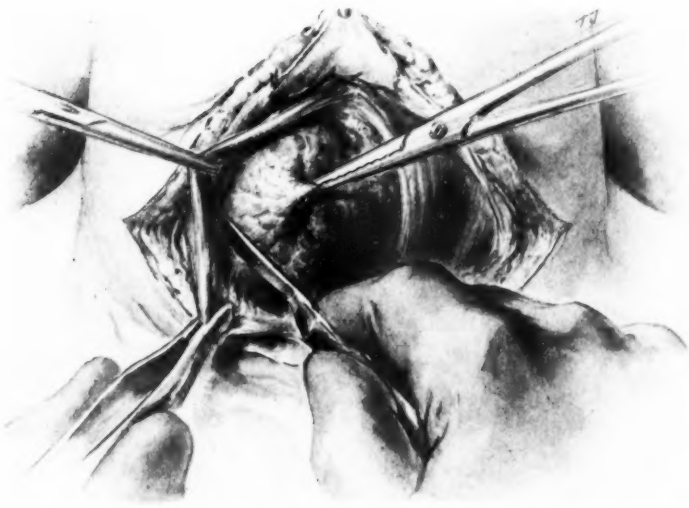


Fig. 5. The ribbon muscles are being pulled laterally by an artery forceps in the hands of an assistant and a thumb forceps in the surgeon's hand. The gland is being gently lifted by an artery forceps. The knife dissects the capsule from the surface of the goiter.

on the size of the goiter. Usually four lines are infiltrated representing lines *3*, *4*, *6*, and *8* in Figure 3. For this step, 3 to 5 cubic centimeters are used.

Without removing the needle from the skin the surgeon next infiltrates the region about the lower pole. The needle is passed downward and outward as represented by line *1* and *9* in Figure 3. The purpose of this step is more to œdematize the tissue about the lower pole than to secure anæsthesia. By this means the line of cleavage is more readily followed. About 5 cubic centimeters are used in this step.

It will be seen that the amount of anæsthetic fluid used is only about 30 cubic centimeters. It is only in large goiters that this amount need be exceeded. The purpose of limiting the amount of fluid is not because of any fear of toxicity but because larger amounts disturb the topography and make exact dissection difficult, thus making impossible the anatomical exactness in every step of the operation which is absolutely essential.

STEPS OF OPERATION

The incision. As soon as the anæsthetic has been injected, the skin, platysma, and superficial fat are incised, exposing the anterior jugular veins (Fig. 4A). These veins are then caught up and the fascia is incised from one angle of the wound to the other. The severed veins are then ligated (Fig. 4B). It is essential that vessels be ligated as soon as cut. The accumulation of many forceps about the wound is unsurgical, poor mechanics, and above all, the pull and clatter of many instruments irritate the patient. Six forceps are enough and more than a dozen is an anachronism in any operation. The fascial flaps are then dissected free from the ribbon muscles (Fig. 4C). A nick is made in the lower flap in order to give greater room for the mobilization of the lower pole. The ribbon muscles are not cut because this is not necessary and the myositis resulting from such injury limits the movements of the larynx after healing takes place. The fascia is cut so as to give greater room, making it possible to remove the gland by sharp dissection, and in order to give a good view of the lateral veins without the use of retractors. There is no objection to cutting the fascia because healing is perfect without disabling after-effects.

Dissecting the gland free. An incision is now made in the midline down to the gland capsule. If the ribbon muscles have been infiltrated to the proper degree a fine layer of œdema will mark this plane. The edges of the muscles are now lifted up with the aid of artery forceps in the hands of an assistant and a thumb forceps in the operator's hands elevates the muscle at the point where the strokes of the knife are being applied (Fig. 5).

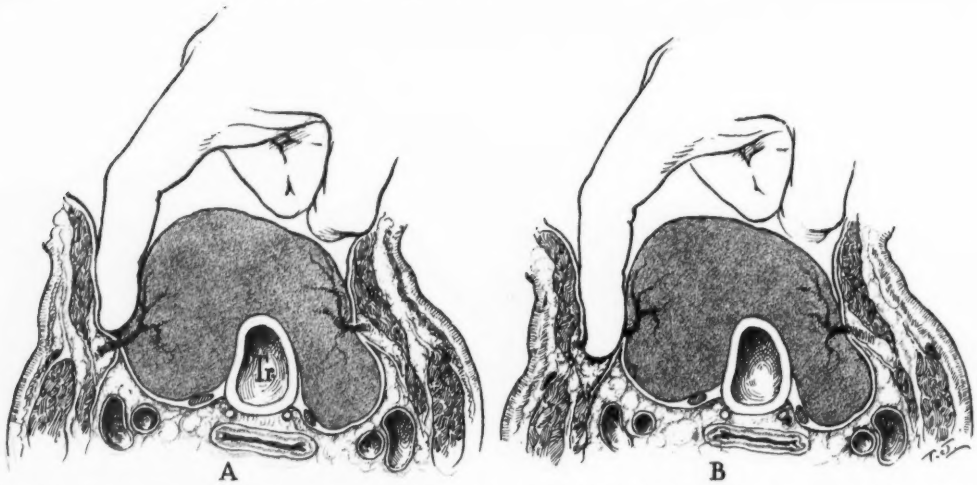


Fig. 6. In A, the middle vein is shown beneath the tip of the finger. The fascia is seen to divide, one leaf going to the carotid sheath, the other passing over the posterior surface of the gland. B shows how blunt dissection follows the outer leaf of the fascia, if the middle vein is not cut.

The gland is freed entirely by sharp dissection. If an attempt is made to use blunt dissection, the exact line of cleavage will never be followed. Here, as in any other delicate dissection, the sharpest knife obtainable is the safest instrument. An artery forceps grasps the gland and makes gentle traction so that the gland may be elevated as it is freed (Fig. 5). The purpose of the forceps, let it be emphasized, is not to extract the gland but to elevate it gently after the knife has freed it. If traction is made on the forceps they will most certainly tear out in all toxic glands. In friable glands, a deeper hold is required than those indicated in the figure.

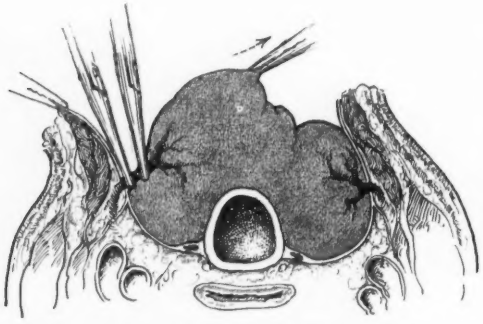


Fig. 7. The middle vein is caught between two forceps. When it is severed the plane of least resistance will be between the medial leaf of the fascia and the gland.

When the gland has been about half freed, the lateral veins come into sight (Fig. 6A). The operator must see these vessels before his knife reaches them. They must be grasped by two forceps (Fig. 7) and a cut made between them. This is one of the important steps of the operation. If the veins are inadvertently cut or torn, a troublesome hæmorrhage ensues, the exact line of cleavage is forever lost, and exact operating from then on is made impossible. The reason for this is that at the point where the lateral vein enters the gland, the fascia divides (Fig. 6A), one leaf going out to cover the carotid sheath while the other passes around the posterior surface of the gland (Fig. 6B). Unless the last named layer is identified, the capsule cannot be followed behind the gland and a proper delivery is impossible. Unless the gland is properly delivered the operator cannot know how much gland he is leaving nor can he determine the existence of pedicled lobes extending beneath the sternum or between the trachea and œsophagus. Likewise, unless the tracheal rings are palpable throughout the extent of the gland the operator cannot know how much of the gland he is leaving behind. This is the most important step of the operation from the standpoint of certain and lasting results.

After the gland has been fully delivered, the steps looking to its removal may be proceeded with.

Ligation of the superior pole. The upper pole is grasped with a pair of forceps and is gently lifted.

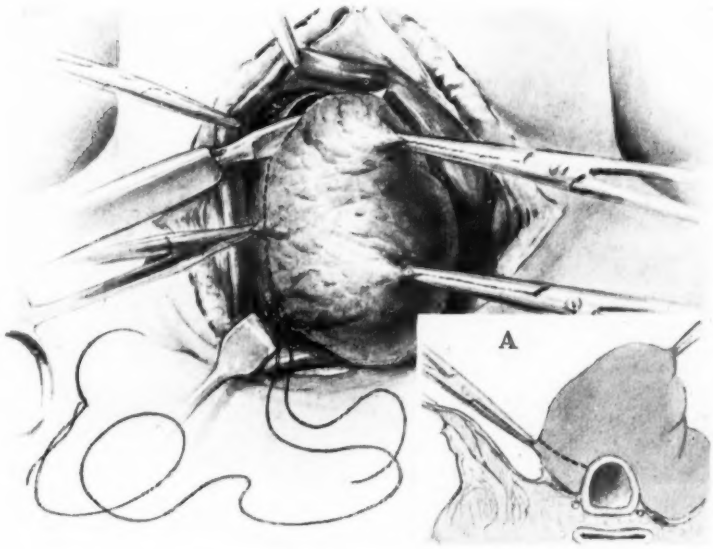


Fig. 10. Both poles have been ligated. The gland is held elevated by means of forceps while it is being severed. The insert shows the position of the guide forceps and indicates the direction of the cut and the amount of gland which is to be allowed to remain.

The index finger of the left hand (Fig. 8) supports the lateral side of the pole while with the handle of the knife the pole is separated from the trachea. If the third step in the infiltration has been properly done, this area will be without sensation and the slight œdema will make separation easy. When the superior pole extends very high up, gradual manipulation of finger and knife handle aided by gentle traction on the forceps will bring the top of the pole into view, no matter how high up it extends (Fig. 8). A Kelly forceps now replaces the knife handle and is gently pushed under the pole and raised up. One must be sure not to use the trachea as a fulcrum or the patient will be made to cough. The pole is lifted up by the raising of the forceps (Fig. 8). With the forceps we then grasp the ligature and draw it under the pole. The ligature is then firmly tied, thus securing the chief blood supply early in the operation. A reversed needle holder or a special ligature carrier may be used for this step. The forceps have the advantage that they enable the operator to elevate the pole at the time the forceps pass under it. This assures a complete exposure of this part of the gland. The ligature must pass around the whole pole and not through it.

Ligation of the lower pole. The lower pole is gently lifted so that the inferior thyroid veins come into view (Fig. 9, frontispiece). A ligature is passed under them and tied. At this stage the lateral branch of the inferior thyroid artery may be palpated and a loop passed around it and tied. The ligature is not cut but is preserved as a starting point for the continuous suture after the lobe has been removed. This point is important, especially in very friable glands, for it makes possible a firm hold.

Excision of the lobe. After both poles have been ligated, the actual excision commences. The index finger palpates the posterior surface of the gland and the point of excision is fixed by means of a pair of forceps, which serves as a guide (Fig. 10). The excision then begins at the upper pole and extends downward. One definite spurting vessel is always encountered—the medial branch of the inferior thyroid artery, which lies close beside the trachea at the level of the upper border of the isthmus. With care it may often be seen and grasped before it is cut. Other smaller vessels, inconstant in situation and number, will be encountered and are grasped with forceps as they are severed. The direction of the cut and the proportion of gland left is shown in Figure 10A. The trachea is always dissected clean. If this is not done, the portion remaining over the trachea is apt to enlarge subsequently, which disturbs the patient

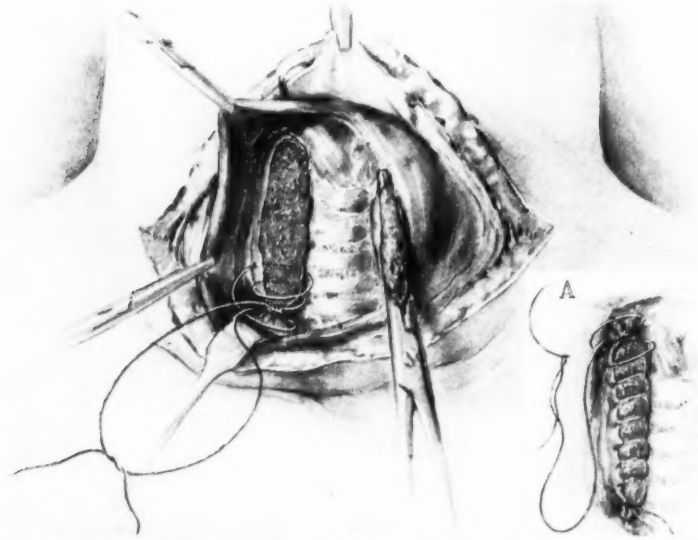


Fig. 11. After the required amount of gland has been removed, the ligature which was passed about the inferior thyroid veins (Fig. 9) is taken up and passed twice through the cut gland to pick up the lateral branch of the inferior thyroid artery. It is then passed through the pedicle below the ligature, looped over the needle, and tied. This serves as a double ligature to the lower pole. Insert A shows the running over and over suture extending from the lower to the upper pole controlling any bleeding points which may be temporarily controlled with forceps. When the upper pole is reached, a suture is passed above the ligature already applied to the upper pole (Fig. 8) and looped over the needle, thus forming a second ligature for the upper pole. A second line of suture is made over the cut edge of the gland until the lower pole is reached and is then tied to the tail of the original lower pole suture.

subjectively and objectively. It is impossible to remove enough of the gland if a part is left to cover the trachea. There is no objection to exposing the trachea. If the capsule has been properly elevated from the gland at the beginning of the operation, and the muscle-fascia layer properly coapted after the operation, there is no impairment of function of the trachea. It may be admitted that the tracheal irritation is greater the first day or two following operation when the trachea is exposed. But what is a day in comparison to a lifetime? The patient wants and the surgeon must have permanent results.

Securing the bleeding vessels. The suture which was used to ligate the inferior thyroid veins is taken up and the needle is passed through the cut glands above the point of ligation (Fig. 11) in one or two places depending on the number of bleeding points encountered. It is then passed through the pedicle below the point of ligation and the suture is locked by throwing a loop over the needle as it is being passed through (Fig. 11), thus securing a double ligation of the pedicle. It is passed through the cut surface again above the pedicle. In the making of this sweep, the lateral branch of the inferior thyroid artery is included. The suture is now tied to the tail of the original suture passed about the inferior thyroid veins. This secures the bleeding about the lower pole. The cut surface of the gland is then whipped over from below upward, care being used to include the bleeding points which have been caught up by forceps. When the pedicle of the upper pole is reached, the suture is passed through the pole above the site of the ligature already in place (Fig. 11A). This is looped over the needle, thus securing a double ligation of the upper pole. The cut surface is then again whipped over and the suture locked now and then about any bleeding points that may remain. This step is continued until the stump of the lower pole is reached. Then the suture is tied to the tail of the original lower pole ligature.

In very friable or large goiters, particularly those that are substernal, the adjacent capsule or muscle fibers may be caught up as the suture is made. This obliterates the dead spaces and gives

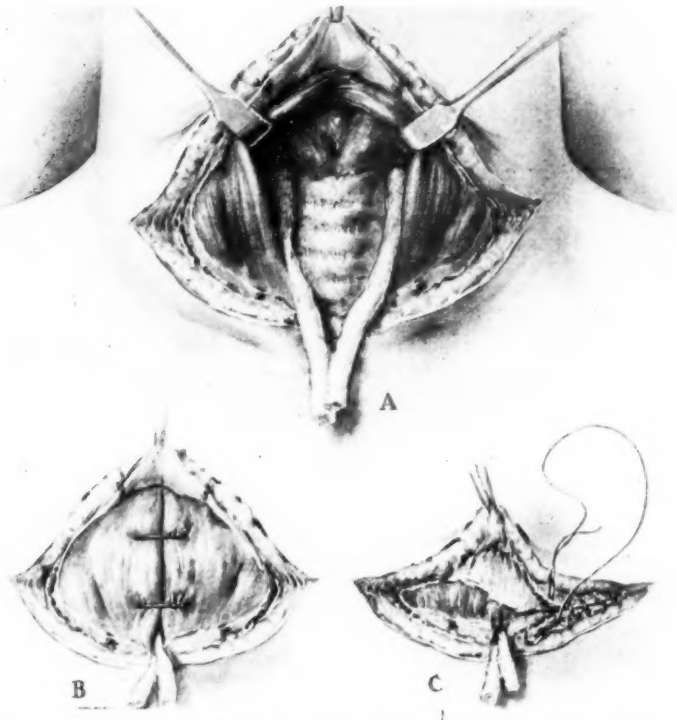


Fig. 12. A, The ribbon muscles are shown retracted while gauze drains are being placed over the raw surfaces of the gland. B, The ribbon muscles are gently coapted with sutures. The gauze drains protrude through the lower angle. C, The fascia is being united by a running suture including in this case the platysma muscle.

additional security to the hæmostasis in friable goiters, and in old goiters gives a lateral traction to the flabby walled trachea. This, however, is used only in exceptional cases.

Management of the second lobe. The second lobe is treated in the same way except that in the very exceptional cases, one must be satisfied with the removal of one lobe. I no longer remove a part of the second lobe; now I remove all or nothing. If it is seen to be inexpedient to remove the second lobe cleanly at the primary operation, it is deferred to a second operation, a week to several months hence, depending on the condition and disposition of the patient. By waiting a month or two we may much more easily remove the second lobe, but in some cases time does not lessen the friability of the gland or its adhesion to the capsule.

Drainage. During the years when I closed the wound myself, I drained only the very toxic cases. My assistants drain more frequently, perhaps about half of the cases. The drain was used because the fragility of the tissue made me fearful of late oozing. I have never drained with the idea of conducting off any toxic secretion which has been alleged to escape from the cut surface of the gland. There is no evidence that such occurs. Since we know how to prepare our patients properly before operation, such hypothecation is unnecessary. When a drain is used, it must be of gauze. A rubber drain should never be placed in any wound that is expected to heal by first intention. The rubber in the wound causes an exudation toward it. This prevents coagulation about the ends of the ligated vessels and invites late bleeding. Along the tract occupied by the rubber drain the exudate tends to produce a lasting fistula. On the other hand gauze hastens coagulation and thus initiates the formation of fibrous tissue which permanently seals the vessels.

The most suitable drain is a wick of gauze laid over the sutured surface of the gland (Fig. 12A).

Closure of the wound. The edges of the ribbon muscles are coapted by sutures, usually two to four in number. The muscle must not be constricted lest a myositis be produced which would limit the movements of the trachea. After the muscles have been coapted, the transverse incision in the fascia is closed by a running suture (Fig. 12B). The drain occupies the nick made in the lower facial flap (Fig. 4). The skin is closed by staple sutures of dermal gut. The platysma may be grasped with the fascia, sutured separately, or neglected entirely.

NOTES FOR THE BEGINNER

It is advantageous to estimate the difficulty of the operation before the patient is brought to the table. Even if the patient is fit for the operation, very hard, fixed glands should warn the novice to be cautious, because the gland is friable and removal will be difficult. It is in such cases that careful infiltration about the gland is particularly helpful. Exactness of technique and not the amount of solution is of prime importance.

If the operator has started and has his morale upset at any step of the operation by excessive bleeding, it is best to pack the wound with gauze and terminate the operation. The best means of avoiding such an embarrassing state is to select only those cases which are in harmony with the operator's experience, and to proceed with great caution, bleeding points being ligated as they are encountered in order to avoid a forest of instruments which impede the movements of the operator. The preservation of the morale of the operator is best assured by a careful technique in which nothing is done, unless the operator is sure he is right. Most mistakes are made by an attempt at blunt dissection with an elevator or finger. Blunt dissection in surgery is the mark and means of a poor operator and this is doubly true in regard to operations for goiter. In rare instances, however, there may be an exception. After the surface of an excessively friable gland has been exposed and the lateral veins have been severed, it may be impossible to secure a firm grasp. With the posterior capsule identified, it is best to follow the lower pole to the posterior surface of the gland with the finger and thus to elevate the gland. Once the gland has been elevated, gauze can be packed behind it so as to maintain the elevation and control the hæmorrhage while the poles are being ligated. If such a procedure has been necessary on the first side, the second side should be deferred for another time.

REMARKS

Failure to secure satisfactory results. There are two common reasons why patients are not cured: an insufficient removal of gland tissue or a wrong diagnosis.

To obviate the first, as much gland should be removed as is technically feasible. The inserts in Figures 10 and 11 represent the procedure which I employ in the average case. The severer the disease the more gland should be removed. This is particularly true in patients with goiter hearts in old colloid goiters. Here small nubs about the upper poles are about all that is left. Even in such radical operations, permanent myxœdema is very rare. Temporary thyroid deficiency is more common and requires foreign gland treatment for a time. These have been my most striking cures particularly in the old cardiac patients. Myxœdema is not to be dreaded. Patients on their "grain a day" live in perfect comfort.

Incorrect diagnosis accounts for many disappointments. Patients with rheumatic hearts, acquired in childhood, may later acquire goiters. These hearts are not cured by goiter operations. History and physical examination should preclude this error. Less easy is the diagnosis of extraneous nervous symptoms in goiter patients. The presence of a goiter does not lessen the importance of a careful consideration of the general nervous state. Early history and a study of other members of the family will aid. The nervous symptoms in thyroid intoxication differ from the vagaries of the neurotic. When both conditions are combined, the surgeon can but accept the proposition, cure the goiter, and have left a neurotic patient. It helps if one can evaluate each factor before the operation. A microscopic study of the gland will materially help in forming an opinion before the patient leaves the hospital. Failure to cure a neurosis should not be charged against the surgeon. A careful diagnosis, clinically and pathologically, will help to make the statistics more favorable to the operative treatment of goiter.

FROM THE CLINIC OF DRS. ORR AND THOMSON

SPECIAL METHODS FOR THE TREATMENT OF FRACTURE DEFORMITIES OF THE FEMUR

BY H. WINNETT ORR, M.D., F.A.C.S., LINCOLN, NEBRASKA
From the Lincoln General Hospital

MALUNION and shortening occur more frequently in fractures of the femur than in fractures of any other part. Moreover, deformity is much more likely to be disabling because of the very important part played by the femur in all activities. In spite of that fact, shortening and disability in fractures of the femur have been quite generally accepted as inevitable. Compensation insurance companies are usually satisfied to settle with a patient who has suffered a fracture of the femur on the basis of from 10 to 25 per cent disability and are thankful if there is no more disability than that.

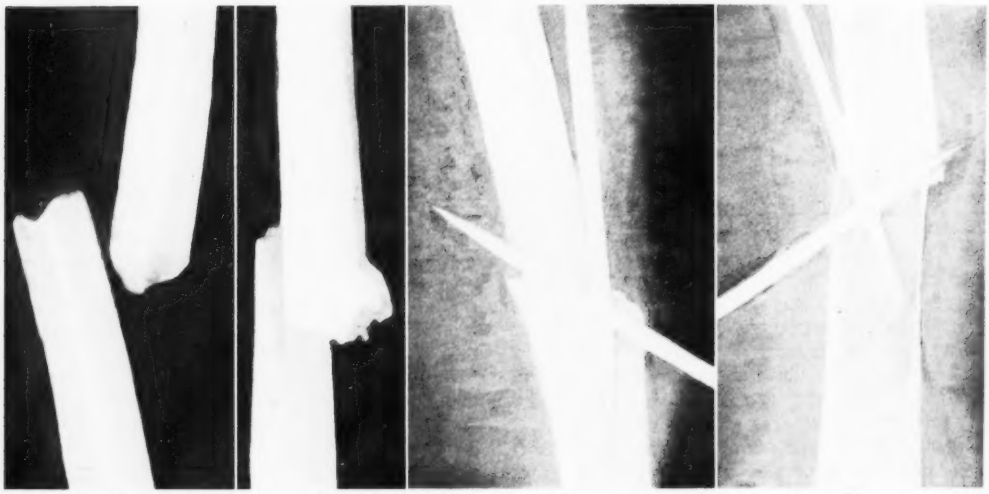
In compound fractures, permanent disability has been considered to be almost unavoidable. In the opinion of the present writer this is largely for the reason that considerations of wound treatment have been permitted to interfere entirely too much with methods of treatment for the fracture itself.

In compound fractures, splinting methods and particularly our best splinting methods have been made subservient to wound treatment and consequently immobilization in correct position has rarely been carried out. This leads to a high percentage of patients with malunion and shortening. Many of these patients come to the hospital late for secondary care. Quite commonly even those with severe disability are discouraged in their search for relief and a large number are turned away to carry on with their deformities and disabilities because of the difficulty of the late correction of such conditions.

Since a considerable number of surgeons were familiarized during the war with the use of fixed traction, Thomas splints, ice tongs, etc., correction is being done more frequently than previously. Even plastic lengthenings of the femur are being done by some experts. These operations are not being done, however, to the extent that they should be. Plaster of Paris has not been used as much as it should be partly because of the perfectly proper objection that with the ordinary methods of application length is difficult to maintain.

The application of plaster with the idea of securing proper position of the fragments by constriction at the point of the fracture is quite wrong. Neither should constriction at the foot be used in an effort to maintain length. In pursuit of a method to render plaster more efficient in maintaining length and to avoid motion of the fragments, we have worked out a technique for the application of fixed traction in plaster that overcomes all of these objections. We do not hesitate to refracture either by the open or the closed method almost any late case of femur deformity. Direct manipulation of the fragments is sometimes done by means of pins as illustrated in Case 1. In other cases we depend upon traction alone with fixation of the lower fragments of the femur by ice tongs and in still others, the careful application of moleskin adhesive traction with the lower ends of the straps imbedded in the cast. This gives fixation with full length as well as satisfactory immobilization of the fragments. It is never necessary to have undue pressure upon the knee or upon the foot or constriction of the cast at the point of fracture. Both the patient and the fractured extremity are kept under complete control by means of adequate fixed extension in the plaster cast. The details of application are as follows:

First, the patient is placed upon a traction table and by means of a muslin bandage about the foot and attached to the traction device at the foot of the table, traction is made upon both legs with the perineum firmly against the upright post of the traction table until full length and position can be maintained by the pull on the foot alone. Second, the knee is raised by means of a pull against the overhead bar with thick padding underneath the knee, until the knee is flexed about 20 to 30 degrees. Now the screw at the bottom end of the table is gradually tightened and the behavior of the fragments at the point of fracture is observed. If by traction and manipulation alone the femur can be brought down to *correct alignment and full length*, nothing more is required. Moleskin adhesive straps are applied to the limb on both sides, extending from above the point of fracture to the malleoli. These moleskin straps are bandaged on by means of sheet cotton and a firm muslin bandage applied over



A *B* *C* *D*

Fig. 1. Mr. M. 4 months after injury. *A* and *B* show the fracture through the callus. The femur united in poor position. *C* and *D* show the method of replacing the fragments by means of levers, the ends of which are left projecting through the wound and fastened into the cast. Traction upon the foot is made in the usual manner during the operation and the ends of the moleskin adhesive traction straps anchored into the cast. This patient has now fully recovered and the femur has good line and full length.

that. The other limb is similarly bandaged except that no moleskin plaster need be applied. A double plaster-of-Paris spica is put on up to the arm pits with a cross bar or double cross bars between the legs.

When the plaster has been finished down to just above the malleoli and has set, the lower ends of the moleskin traction straps are turned back over the edges of the cast and fastened into the cast by additional turns of the plaster bandage. In this way, one locks the traction while the foot is still being firmly held in traction by the muslin bandage.

When the entire double spica has set down as far as the ankles the traction by the muslin bandages on the feet may be released. It will be observed that the leg does not jump back into the cast as is the case in the ordinary cast.

Now the foot may be brought to a right angle and after having been covered with cotton is included in the cast in correct position. The position of the fragments may be checked on the traction table if desired, either by the fluoroscope or by X-ray plates taken at the time. If correct position cannot be obtained in this way, open operation should be performed and the fragments brought into correct position by means of levers or some other means. A bone graft may be inserted but this is usually not necessary.

In many cases of open operation, fixation of the lower part of the fragments by ice tongs is to be preferred to the moleskin traction method. In such a case, traction is applied to the foot as already described and the knee is supported in the same manner except that the bandages should be kept out of the way of the condyles so that there may be no interference in the placing of the ice tongs. After position of the fragments is obtained by manipulation through the incision, pins may be employed, if desired, as in Case 1.

To maintain the fragments in position for the time being, the wound is closed in the ordinary manner, the pins are left extending out far enough beyond the skin so the ends of the pins may also be included in the cast. Without disturbing either the traction on the foot or the support of the knee, the condyles are prepared to receive the points of the ice tongs and these are driven in. No traction need be made on the ice tongs. While traction is not necessary, gentle traction may be used if desired and the lower fragment of the femur may be gently supported by means of a pull either longitudinally or forward upon the ice tongs. Care should be taken that the handles of the ice tongs do not rest upon the crest of the tibia below the knee.

Now the operative incision in the skin at the point of fracture and at the point of insertion of

A *B*

Fig. 2. H. H., Dr. Dudley s patient. *A*, Condition on June 20, 1927, about 10 months after injury. *B*, Condition on September 21, 1927. All sinuses and operation wound were healed. Patient was able to walk in caliper splint and with crutches.

the ice tongs must be carefully covered with sterile dressings and a double spica put on in the same manner, so that the ice tongs are embedded in the cast and made a part of it. In the same manner as before, the cast is carried down to below the ice tongs and, when the plaster is set, the release of the foot where traction is being made by muslin bandages may be done without any disturbance of the fragments of the femur either as to shortening or rotation. There is no jumping back of the leg into the cast and the foot can be put in correct position and the cast finished without any disturbance of the fragments of the fractured femur.

In this manner perfect length, accurate position as to rotation, and complete immobilization are obtained. The traction need not be disturbed for weeks and recovery with the parts in correct position is assured.

I wish to report the following case, which was operated upon with Dr. F. H. Dudley and Dr. Roger Anderson in Seattle, Washington, in June, 1927. As to operation and after-care the conduct of this case was identical with many other cases that we have treated in a similar manner.

Mr. H. H., 42 years of age, sustained a compound fracture of the femur in July, 1926. Several operations were performed but in June, 1927, he presented the following condition:

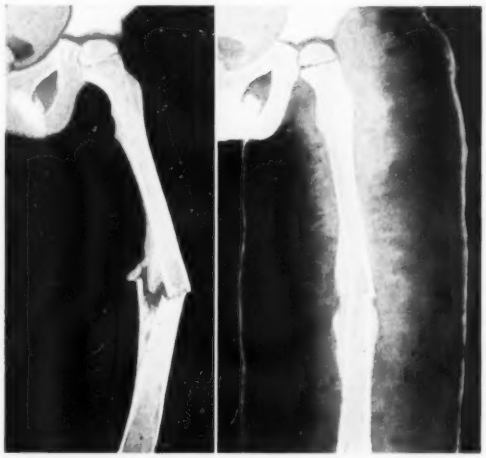


Fig. 3. Compound fracture with osteomyelitis and deformity 4 months after injury. Saucerized and deformity corrected at the same time. Soundly healed in good position 3 months after operation. Only 2 dressings were applied. Moleskin adhesive plaster fixed in the cast at the ankle was used for traction.

There was marked outward and backward bowing of the femur in the middle third. The limb was about 2½ inches short. There were two large sinuses draining freely through scars on the anterior and posterior surfaces of the thigh.

Fig. 4. Showing traction and fixation of the lower fragment of the fractured femur by ice tongs embedded in the plaster cast. The ice tongs were left in for 4 weeks. End-result 2½ years later. The patient was 62 years old.

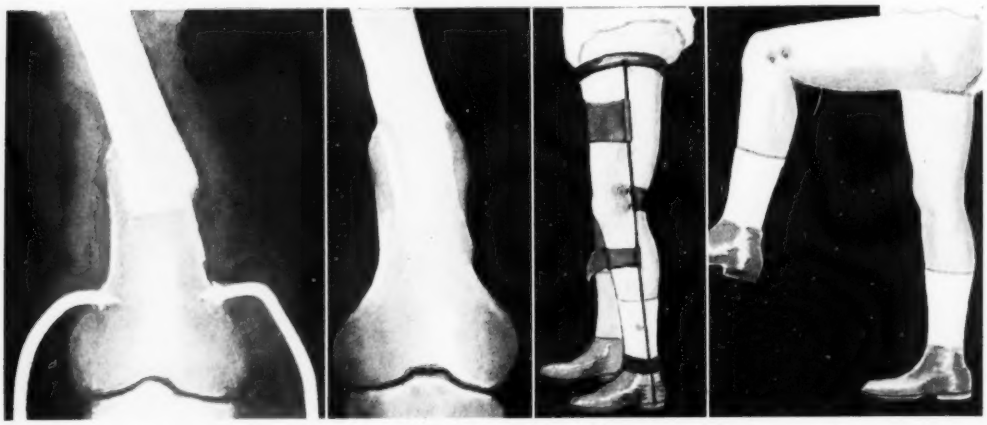


Fig. 5. Mr. F., 32 years old. Compound comminuted fracture of the lower third of the femur treated immediately by ice-tong fixed traction in double spica plaster cast. Ice tongs were left in for 6 weeks. Two dressings sufficed. The plaster cast was removed after 10 weeks. Condition shown at the end of 5 months.

There was slight flexion deformity of the knee and the foot was in fixed equinus. The X-ray (Fig. 2) showed marked deformity and numerous sequestra in a large cavity in the femur. There was callus formation on two sides of the abscess cavity but repair of the femur as a whole was not successful.

Operation for correction of the deformity and to relieve the chronic osteomyelitis was agreed upon. The patient was placed upon the traction table and strong traction made upon the foot. With additional moderate lateral pressure the femur was at once considerably straightened without much difficulty. The entire thigh, down to and including the knee, was cleaned with tincture of iodine. On account of the extensive scarring on both the front and back of the thigh, it was decided to approach the fracture area laterally. An incision about 8 inches long was made directly down to the femur and the sequestrum cavity was cleaned out. From the abscess cavity a number of sequestra were removed, the largest being about 1 by 1¾ inches. Then, a further attempt was made to improve the position of the fragments by force applied directly to the femur and by tightening up the pull upon the foot. As a result the limb was brought down to nearly full length but a complete fracture of the callus occurred.

Next, the entire abscess cavity was wiped out with tincture of iodine and alcohol and packed wide open with vaseline gauze. No drainage tubes or sutures were used. Ice tongs were inserted into the condyles of the femur. The bone was so much decalcified that the shoulders of the ice tongs broke through into the interior of the epiphysis. Notwithstanding this the handles of the ice tongs were included in the cast and a double plaster-of-Paris spica was put on. After the cast had been finished to below the ice tongs the pull of the muslin bandage upon the foot was released and the equinus deformity of the foot also corrected by means of a Thomas wrench. The cast was then extended downward to include the foot which was put up in dorsiflexion at a right angle with the leg. The patient was placed in bed with the foot of the bed elevated and a 20-pound weight attached to the cross bar of the cast and hanging over the foot of the bed.

No dressing was done for some weeks. All secondary dressings at intervals of 2 to 4 weeks were done with iodine and vaseline the same as at time of operation. There was no loss of position and no complications. In September the patient was up and about in a caliper splint with crutches and left the hospital. All wounds were healed and he had less than 1 inch of shortening.

GASTRIC EXCLUSION

By H. B. DEVINE, M.S., F.A.C.S., Melbourne, Australia
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THE technique of gastric exclusion was reported in Surgery, Gynecology and Obstetrics in January, 1925. The principle of it is that, provided the pylorus is patent, one-half or more of the distal part of the stomach is excluded and left in continuity with the duodenum. In my later cases I have made the section of the stomach obliquely (Figs. 1 and 2) so as to include more gastric canal and exclude more gastric fundus with its acid producing glands. The oblique section also insures a greater intestinal alkaline regurgitation, better gastric emptying into the distal segment, and a more manageable intestine-like excluded segment.

The method of exclusion depends on the circumstances. It may be carried out by an anastomosis after the fashion of a Billroth II or a Pólya, or by the modified Pólya anticolic method of Balfour. The more of the stomach that is excluded, the greater and the more uniform the reduction of acid, the quicker the emptying time, and, therefore, the more consistent and better the result.

That the excluded segment gives no trouble but contracts somewhat and remains empty was shown at secondary operations on two patients about 12 months after the operation for partial gastric exclusion; that there are no by-effects from it was manifest from the symptomless post-operative course of the patients on whom it was done. The closure of the excluded segment, which is peculiarly easy, is the only addition to the technique of a gastro-enterostomy and this is amply compensated for by the absence of untoward, unforeseen, uncertain effects often obtained in the "double-exit" stomach resulting from gastro-enterostomy. Gastric exclusion is an operation which was not designed for routine use but for special application in certain cases. In a few special instances no other operation can attain its possibilities both as regards lessened risk and permanent cure.

In what follows I shall attempt to define the precise application of gastric exclusion and to set out the particular kind of gastric or duodenal lesion in which I have found this operation of special use.

DUODENAL ULCER

In very old duodenal ulcers, so great may be the callus and tumor formation that healing will not take place with the simple drainage and reduction of acid which gastro-enterostomy gives. The tissue is so damaged and thoroughly infected that even if healing does occur, the infected area never really recovers its original vitality. In addition, the scar tissue retains a residual infection which, under the influence of some general or local depression of resistance, even years after a gastro-enterostomy, may cause the development of an acute ulcer in this old scar and produce fatal hæmatemesis.

If the ulcer is penetrating and situated on the posterior duodenal wall, healing is even more intractable. This class of duodenal ulcer is usually associated with a very high acidity, and, judging from our own clinical experience and modern experimental work, the ulcer is undoubtedly caused by this high acidity from the very outset. Gastro-enterostomy is notoriously uncertain in bringing about reduction of acid, and it is doubtful if the most ideal gastro-enterostomy can adequately reduce the very high acidities in this type of case. So that in the circumstances—high acidity and old ulcer—to do a gastro-enterostomy is not in keeping with the best principles of treatment and is to invite failure sooner or later. Gastro-enterostomy, combined with the removal of the very diseased old ulcer, gives more prospect of permanent cure, but it is often almost impossible and, even if possible, very dangerous to remove some of these very old duodenal ulcers, and even if resection is possible the gastro-enterostomy may not adequately reduce the high acid. Finsterer would do a partial gastrectomy and duodenectomy in order to accomplish these ideals. We would do a partial oblique gastric exclusion which avoids the dangers of partial gastrectomy and the greater ones of partial duodenectomy and obtains the same uniform and consistent reduction of acid as does a partial gastrectomy, and, by permanently excluding the diseased area, the same certain and permanent healing of the ulcer.

Gastric exclusion was done on 18 patients suffering from duodenal ulcer of this type. One very weak patient died as the result of the operation. Three patients were operated on by Mr. R. C. Brown, surgeon of the Alfred Hospital, Melbourne, who has kindly permitted me to publish the results. He says: "They are the best results I have had from any operation for duodenal ulcer.

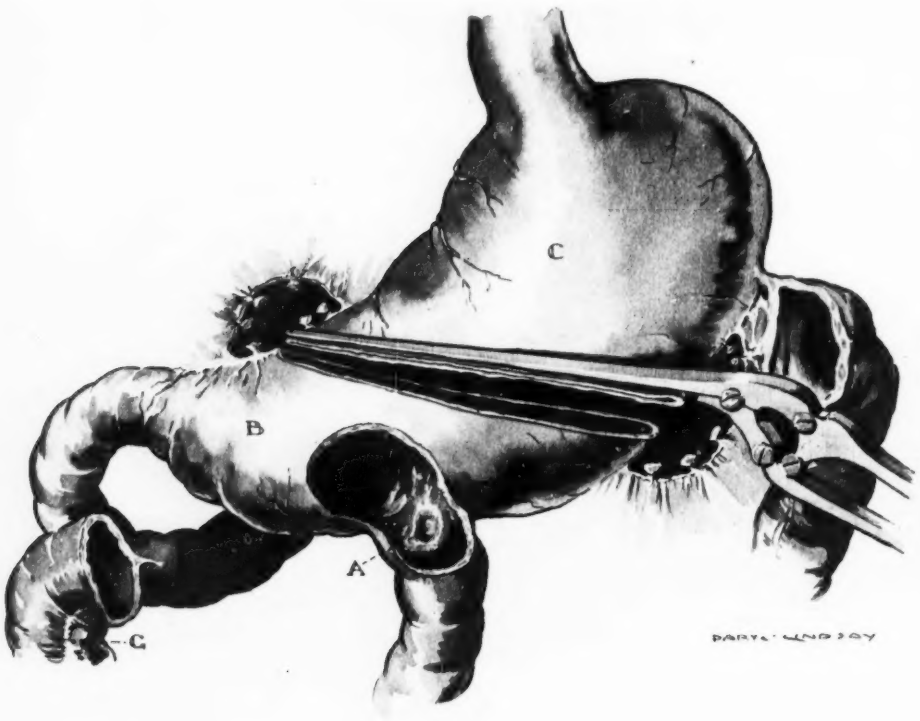

Fig. 1. First stage of oblique partial gastric exclusion for jejunal ulcer. Oblique division of stomach. Window cut to show jejunal ulcer, *A*, and gastro-enterostomy stoma; *B*, excluded segment; *C*, portion of stomach to which anastomosis is made; *G*, transverse colon.

If your operation will relieve the mind of the surgeon of the anxiety of gastro-enterostomy, it will be worth while and, as far as my experience goes, it does so." In these patients Mr. Brown divided the stomach 4 inches from the pylorus. He says: "The patients are back at work, have no symptoms whatever, are putting on weight and can eat anything."

Besides being particularly suited to very old ulcers or those associated with very high acidity, gastric exclusion will save much anxiety and heartburning to the surgeon, if he uses it in place of gastro-enterostomy in duodenal ulcer in women, even though there is not a high acid. The female stomach, with its low "gradient," a term borrowed from Alvarez, lacks the physiological essentials necessary in gastro-enterostomy, and this hypotonic stomach with its double exit allows excessive intestinal regurgitation which, not infrequently, causes nausea, flatulence, and other very unpleasant symptoms. The exclusion, which is generally made a little nearer the pylorus in women, with its single exit, in our experience never gives any of these unexpected by-effects.

BLEEDING DUODENAL ULCER

Under this head, two problems of a very different nature may be presented. In the first, bleeding may occur in a very old ulcer from erosion of a fair sized artery. Here resection of the ulcer, in addition to a gastro-enterostomy, is called for, but is not always practicable. In one very exsanguinated patient, an oblique exclusion, as in Figure 1, was done after a transfusion, with immediate success and, so far, permanent cure.

In the second, the bleeding may come from recurring acute duodenal ulcer, and it will generally recur after a gastro-enterostomy. Here probably the exclusion of the ulcer bearing area is more important than any reduction of acid.

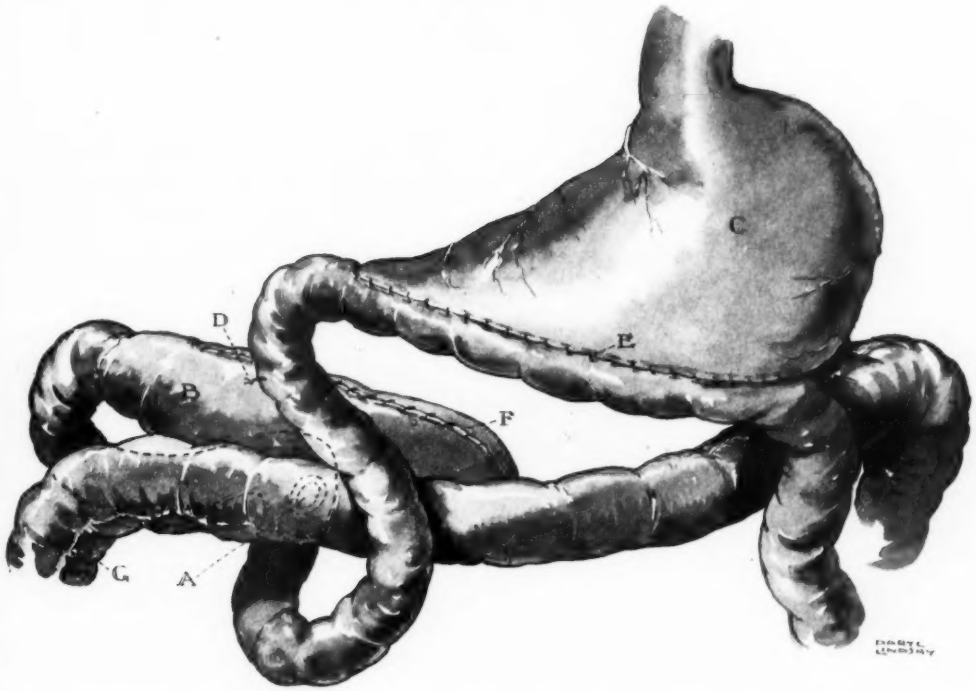

Fig. 2. Second stage of oblique partial gastric exclusion for jejunal ulcer. *A*, Gastro-enterostomy stoma and jejunal ulcer; *B*, excluded segment; *E*, oblique anastomosis, anticolic, which avoids kinking and insures regurgitation where the afferent loop enters the stomach. Similarly the almost transverse position of the intestinal loop removes any tendency to angulation and facilitates emptying into the efferent loop; *C*, portion of stomach to which anastomosis is made; *D*, jejunum anchored to excluded segment to prevent angulation; *F*, suture line of excluded segment; *G*, transverse colon.

PREPYLORIC ULCER TUMOR

It is not uncommon to meet with a large inflammatory tumor in the prepyloric region of the stomach. This generally arises from a penetrating ulcer and has extensive adhesions to vital structures in the vicinity. It is very difficult and, in some cases, impossible to remove such a tumor, and when it is associated with a chronic perforation, as it sometimes is, this tumor presents almost insuperable difficulties to operative removal. In addition, patients with these ulcer tumors are very sick, cachectic and emaciated, either because such an ulcer causes great debility or is prone to occur in very feeble persons, so that it is obvious that there is not much latitude for the necessarily extensive operative manipulations.

The following is a history of such an operative gastric problem:

J., male, aged 50 years, had been sick for many years with pain 2 hours after meals. Latterly he developed intense epigastric pain and had finally become very ill and rapidly lost weight and became very cachectic. He appeared to be suffering from late gastric carcinoma. He collapsed in my rooms when he had a pulse of 130 and a tender and rigid epigastrium.

Operation disclosed a very large, inflammatory and apparently irremovable prepyloric tumor which had formed around a penetrating ulcer with a small chronic, well localized perforation. Of course, partial gastrectomy was indicated but the patient's condition would not permit of this, even if removal were possible, so a partial gastric exclusion was done, in 40 minutes, with no difficulty whatever. The patient quickly improved.

Our experience has been that gastro-enterostomy would be quite inadequate in such circumstances and could not be depended upon to give the same consistent and permanent result.

A second patient, treated in a similar manner, gave a similar satisfactory result.

It is here interesting to note that although the symptoms were at once relieved, I should judge from observations on the local condition that it

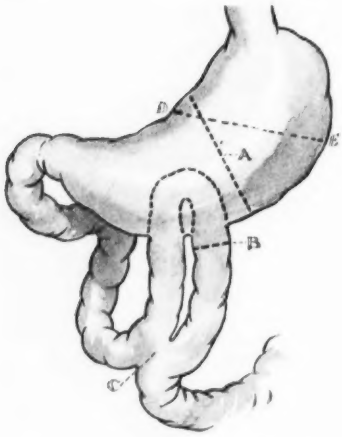

Fig. 3. Diagrammatic sketch showing partial gastric exclusion for jejunal ulcer with entero-anastomosis. *B*, Gastro-enterostomy stoma with jejunal ulcer—dotted line shows where jejunum was divided; *C*, entero-anastomosis; *A*, section of stomach previously practiced; *D-E*, section now favored.

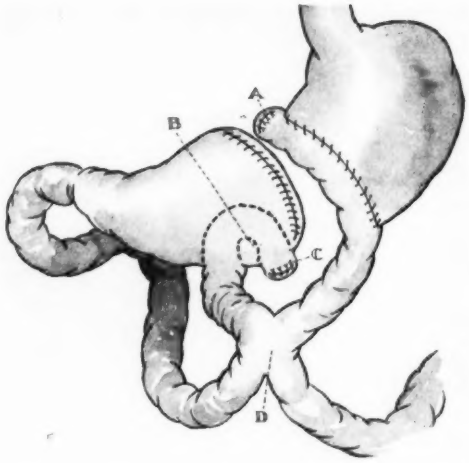

Fig. 4. *A*, Efferent loop from gastro-enterostomy stoma divided, the end closed, and the loop brought up behind the colon to be anastomosed with the stomach. *B*, Gastro-enterostomy stoma (with jejunal ulcer) draining excluded segment; *C*, afferent loop from gastro-enterostomy stoma divided and closed; *D*, entero-anastomosis.

took about 3 months for the very chronic ulcer to completely heal.

The statement has been freely made that carcinoma develops on such ulcers. If this hypothesis is accepted, this operation may be regarded as a first stage preparatory to a later, easy and safe removal of the healed ulcer area. But much recent pathological work appears to throw considerable doubt on this. The fear of cancerous degeneration of the ulcer then may be advanced as a strong argument against gastric exclusion in these very sick patients.

HOURGLASS STOMACH

The great weakness of the patient was the main indication for gastric exclusion in an almost complete hourglass stomach on which it was done.

The distal sac was disconnected and closed and a Billroth II was done, a quick and easy operation. The patient is in perfect health after 12 years and has never had a symptom, so that from this it may be deduced that the excluded segment of the stomach does not produce any symptoms.

JEJUNAL ULCER

It is our experience that exclusion is of inestimable value in a few very weak patients suffering from jejunal ulcer. It has been, and still is, our custom to remove the jejunal ulcer by an enterectomy and partial gastrectomy, but this may not be prudent in jejunal ulcers with profound bleeding and with innumerable and cartilaginous adhesions resulting from many operations, and especially if there is great debility or, if in addition, the ulcer is in an old person. The risk is grave in such circumstances and may be avoided. In these patients it is an essential principle that more than half or perhaps two-thirds of the stomach should be excluded in order to reduce the acidity sufficiently and so as to keep clear and well to the left of the jejunal ulcer and the adhesion area. This can be accomplished only by making the section of stomach obliquely as in Figures 1 and 2, and the anastomosis of the jejunum to stomach by the anticolic Pólya method of Balfour.

The following are histories of patients who were operated on by this method:

Case 1. B., male, age 50 years, had been operated on four times for jejunal ulcer. The ulcer had been repeatedly resected and the stoma enlarged. He was very weak and debilitated and exsanguinated. Operation disclosed a large jejunal ulcer adjacent to stomach, colon, transverse mesocolon, small intestine and its mesentery, all forming a tumor in which, because of the many operations and extensive inflammation, all lines of cleavage between these structures were lost. A partial gastrectomy and enterectomy in the circumstances would have been most difficult and, in the patient's condition, very dangerous.

Through an incision well to the left of the previous incisions, and well to the left of all his previous operations, avoiding all adhesions and working on clean stomach and intestine, we performed a partial gastric exclusion (Figs.

1 and 2). Three years later this man was in perfect health and had gained two stone in weight. He has never had a gastric symptom since his operation.

CASE 2. M., male, aged 73 years, was a very sick man indeed. He had had three operations—one of them a small partial gastrectomy—for jejunal ulcer. Operation was thought inadvisable because of his age and general condition but, as he was in great agony, a gastric exclusion was decided upon. This was quite easily tolerated and gave immediate and complete relief. Two days after getting up, and 3½ weeks after the operation, he dropped dead from heart failure, probably as a result of disease of the coronary arteries.

CASE 3. D., male, aged 55 years. This patient had a history of duodenal ulcer for 20 years and was one of the worst I have ever seen. During the last 6 of these years he had three operations upon the stomach by three different surgeons, without relief. Severe pain, vomiting, and frequent copious hæmorrhages had reduced the patient to a state of misery and weakness. He lived in daily terror of hæmorrhage, through which he had been almost exsanguinated on three occasions. He was extremely pale and the upper part of his abdomen showed five laparotomy scars. Radiographic examination disclosed jejunal ulcer. Operation revealed his stomach and bowel tangled in a confused mass by adhesions. Separation of these disclosed an old gastro-enterostomy and entero-anastomosis with jejunal ulcer at the site of the former. The patient was so ill, and the state of his upper abdomen so terrible, that it was considered wise not to explore the duodenum. The jejunum was divided just distal to the jejunal ulcer and both sides closed. Somewhat more than half the stomach was excluded and the remainder anastomosed into the distal piece of jejunum (Figs. 3 and 4), thus side-tracking the ulcer and leaving it in a blind end, the old entero-anastomosis remaining for the passage of the duodenal juices. The patient 2 years later had quite recovered, had gained weight, and had no gastric symptoms.

It is conceivable that the retention of the entero-anastomosis, decreasing, as it does, intestinal regurgitation, might predispose to a recurrence of the ulcer, but under the circumstances it was difficult to do otherwise.

BLEEDING GASTRO-ENTEROSTOMY

After gastro-enterostomy, a patient may suffer from repeated severe hæmorrhages without the symptoms of chronic jejunal ulcer; pain may be entirely absent. The patient may be quite well in the intervals. This bleeding, which has its analogue in the bleeding duodenal ulcer, probably arises from an acute recurring jejunal ulcer. It is difficult to know how to treat these patients. Partial gastrectomy is indicated but must be extensive and, therefore, unnecessarily mutilating in order to accomplish its object. For these I have performed extensive gastric exclusion with great satisfaction and very little disturbance.

In these cases I invariably make the section of the stomach very obliquely (Figs. 1 and 2) so as to include more of the gastric canal and exclude as much as possible of the fundus and its acid producing glands. As I place the distal part of the jejunum to the greater curvature the obliquity also insures greater alkaline regurgitation. As the excluded segment is drained by the first gastro-enterostomy stoma, it can be made very big. Here is an example of such a case:

H., aged 50 years. This man had symptoms of duodenal ulcer. He was operated on, a duodenal ulcer was found, and a posterior gastro-enterostomy was done. For the last 4 years since his operation, he has had severe attacks of hæmatemesis and mælena, in one of which he nearly died. He has never had any pain after meals nor any other symptoms of chronic jejunal ulcer, except, perhaps, an "acidity" which generally preceded an attack.

An extensive oblique partial gastric exclusion was then done.

Here it was possible to make a valuable comparison of the fractional test meal and emptying time of partial gastric exclusion with the gastro-enterostomy where both the operations were done on the same patient:

Fractional test meal—¼ hour readings.

Bleeding gastro-enterostomy. Free acid, 10, 45, 55, 20–15. Emptying time 1 hour.

After exclusion. Free acid, 0, 0, 0, 0, 0, 0. Emptying time 10 minutes.

This is quite typical of the results we have obtained in several of these cases and clearly shows that partial gastric exclusion gives a much quicker emptying time and a very much greater reduction of acidity than does the operation of gastro-enterostomy.

While it is not possible yet to furnish reliable remote results in the 40 cases operated upon, some general conclusions may be drawn. The results are just the same as for a partial gastrectomy of the same extent. Like partial gastrectomy for duodenal ulcer, if gastric exclusion is too limited, there is danger of the occurrence of jejunal ulcer because there is insufficient reduction of acid. Where from one-half to two-thirds of the stomach has been excluded in the oblique exclusion, a uniform and satisfactory result both immediate and remote has been obtained. In fact it will give the very same results as Finsterer's partial gastrectomy and duodenectomy for duodenal ulcer, with half the operative risk. As far as experience goes, this operation has been found to be practically free from any unpleasant after-effects that often attend gastro-enterostomy and is an extraordinarily useful operation to, as it were, "have up one's surgical sleeve."

SURGICAL RESULTS IN PEPTIC ULCER[1]

By J. TATE MASON, M.D., F.A.C.S., Seattle, Washington

DIVIDED opinion as to the merit of gastroenterostomy for peptic ulcer is current because both satisfactory and unsatisfactory results have been reported by capable surgeons. With this in mind a study of the records of the patients who have been operated upon by us was begun, and while our group is not large, we have tried to make up for the small number by an accurate personal investigation of most of the cases. This study has revealed some matters of interest in connection with this particular operation which may be worthy of note.

Blackford and Dwyer made a study at our clinic of 2,500 consecutive histories of patients complaining of gastric symptoms, and found that only about 1 out of every 7 cases received a diagnosis of organic lesion of the stomach and duodenum. Only 1 out of every 3 cases diagnosed as gastric or duodenal ulcer came to operation. In other words, only about 1 out of every 21 of these patients who came in thinking that they had some organic lesion of the stomach and complaining of what they thought were symptoms of such disease really came to operation for peptic ulcer. One hundred and twenty-five gastric and duodenal lesions have been treated surgically, of which 27 were gastric ulcers and 81 were duodenal ulcers.

In this series the histories were all written and the physical examinations were all made by competent internists. The average age of males with duodenal ulcer was 40 years, the average age of females, 43 years. Duodenal ulcer occurred in about the proportion of 3 in the male to 1 in the female. The age of males with gastric ulcer averaged 48 years and of females, 41 years. Here again the proportion of male to female was about 3 to 1 in number.

The histories alone, in 80 per cent of these cases, pointed conclusively to peptic ulcer. There was the story of hunger pain. In fact, pain was the predominating symptom of peptic ulcer. This pain was usually present from a few days to a few weeks with complete, or practically complete, remission of symptoms for months. It was usually one of three distinct types. The first type of pain due to intragastric or intraduodenal lesion was that due to excessive peristaltic action. In these patients, sharp peristaltic waves follow each other. The increased peristalsis results from the increased secretion, which is the result of the irritation produced by the ulcer. The next most frequent pain of which patients complained and described as a gnawing sensation, is due to the action of the hydrochloric acid upon the base of the ulcer. The third type of pain and that which is usually the most distinct of all is that of impending perforation with associated acute inflammation in and about the base of the ulcer. This pain often simulates gall-stone colic and is not relieved by soda or food as are the first types mentioned.

Tobacco habit has been noted in most of the histories of the male patients. Vomiting occurred in about 60 per cent of the cases. Hæmorrhage varying in amount from very slight to very large, occurred in about 25 per cent of the cases. As has been noticed often by other observers, the majority of these patients complained of acute exacerbations of symptoms in the spring and fall.

There was a small group of patients from whom practically no history of gastric symptoms could be obtained, and in this group some of the ruptured gastric and duodenal ulcers occurred. These patients gave absolutely no history of trouble up to the time of perforation. However, on rechecking these cases, some very good histories were elicited.

Next in importance to the history was the roentgenological evidence. In this group of cases there were positive errors of the roentgenologist in operative cases, i.e., a roentgenological diagnosis of ulcer was made but no ulcer found at operation. Negative errors numbered 10, i.e., a negative roentgenological diagnosis was made but ulcer was found at operation. This was a total positive and negative error of 15 out of 104 patients who underwent operation. The errors were as follows: 1 positive error and 3 negative errors for gastric ulcer and 4 positive and 7 negative errors for duodenal ulcer: a total gross error of 14.4 per cent. Duodenitis was definite in 3 patients listed as 3 of the negative errors among the duodenal ulcer cases.

Acute perforation occurred in 15 patients. Four died; of these, 2 were operated upon 4 days, 1 was operated on 8 days after perforation; and a woman 70 years old was operated upon at 6 hours. Three patients with perforated gastric ulcer who were operated upon within 24 hours, recovered.

There have been 125 operations for peptic ulcer upon 118 patients. One sleeve resection was done but the final results were not satisfactory. Gastroenterostomy was performed 2 years later with

[1] Read before the Southern Surgical Society at Augusta, Georgia, December 13-15, 1927.

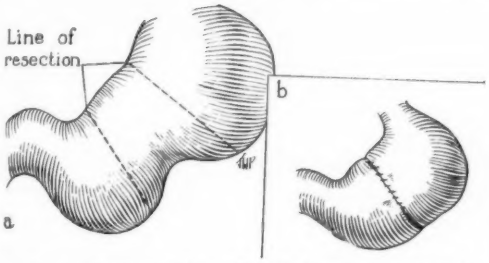

Fig. 1. Sleeve resection. The final result was not satisfactory. Gastro-enterostomy gave relief but the patient died later of cardiorenal break.

complete gastric relief. The patient died later of cardiorenal break. Two Horsley operations, 4 Finney operations, 4 Pólya-Balfour operations, 7 Judd operations, 16 excisions, and 90 gastro-enterostomies were done. Of the 2 patients who were submitted to the Horsley operation, both have done well though 1 had a very stormy convalescence. After a Finney operation, 1 patient made an uneventful recovery while 3 had a considerable amount of immediate postoperative trouble. One of these had persistent vomiting which was finally controlled by daily gastric lavage with a very weak solution of nitrate of silver. One had a duodenal fistula which finally closed spontaneously. The final results in these cases have been satisfactory. The 3 Pólya-Balfour operations all gave satisfactory results except in 1 patient with syphilis of the stomach who died of pernicious anæmia 4 years after the operation. Seven patients who had the Judd operation had a very even convalescence in the hospital, and while the period of observation is shorter than that of any of the gastric operations, the results have been most satisfactory up to the present.

Of the 91 patients upon whom gastro-enterostomy was performed for peptic ulcer, we have been able to communicate personally with 70. A physician spent from 15 minutes to an hour discussing with each patient his present condition. Of the 21 remaining cases, 11 died and 10 have been heard from indirectly through friends who have seen them within a year and a half after their operation.

We are most interested in the number of deaths and the poor results in comparison with the good. Following is a list of these results. There were 4 hospital deaths, or 4.4 per cent. One of these patients made an uneventful recovery but died from pulmonary embolism on the fourteenth day as she was leaving the hospital. One died on the tenth day from a complete separation of the

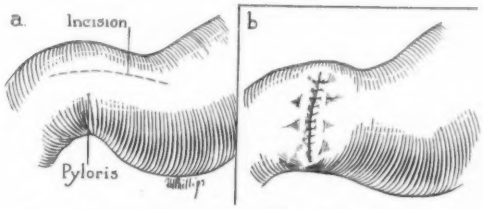

Fig. 2. Horsley operation. The final results of 2 Horsley operations were satisfactory but 1 of the patients had a stormy convalescence.

gastrojejunal anastomosis. In this operation no non-absorbable material had been used. The anastomosis had been made by especially prepared catgut welded onto a straight needle. This we had thought would withstand the digestive action of the gastric juice. At the postmortem, absolutely no catgut could be found, even the knots having been absorbed by the tissues. The third patient died on the third day from pneumonia. The fourth died on the sixteenth day from postoperative insanity. A postmortem examination showed that the gastro-enterostomy opening had functioned normally and that there was no peritonitis. There have been 8 late deaths in this series, 2 from what was undoubtedly perforation of a gastrojejunal ulcer.

There have been 10 poor results, that is, 12.6 per cent of the number of living patients have not had entirely satisfactory results.

Two patients each had a large postoperative abdominal hernia. In a third case the anastomosis had to be disconnected on the seventh day because of persistent vomiting. It was found that the mesentery of the transverse colon had slipped down over the proximal and distal loops of the jejunum. This patient continued to complain of his stomach symptoms for about a year when another gastro-enterostomy was performed. This has since functioned satisfactorily although the patient still complains of some symptoms.

In a fourth patient the anastomosis had to be disconnected on the fourteenth day because of persistent vomit-

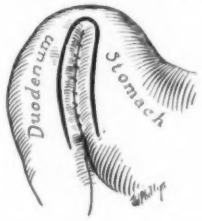

Fig. 3. Finney operation. The final results were satisfactory in the 4 patients on whom this type of operation was performed but 3 of them had a stormy convalescence. One had a duodenal fistula and another vomited persistently.

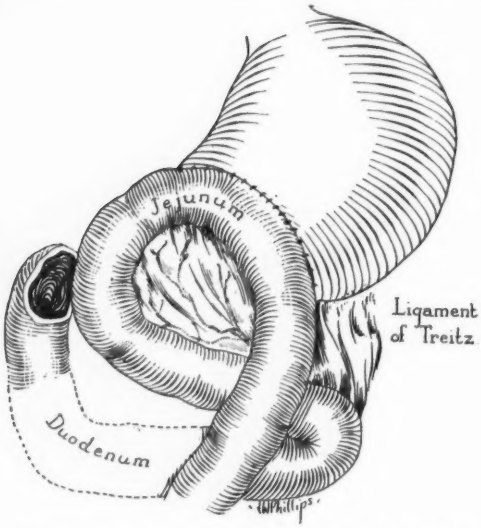

Fig. 4. Pólya-Balfour operation. In 3 cases the results were satisfactory. A fourth patient had syphilitic ulceration and a leather-bottle stomach and died 4 years later of pernicious anæmia.

ing. In this instance also, the mesentery of the transverse colon had slipped down over the proximal and distal loops of the jejunum. The duodenal ulcer had been excised at the first operation. This patient still complains of some gastric symptoms.

A fifth patient continued to complain of pain and discomfort. Sixteen months after the first operation, laparotomy was again performed. At this time many periduodenal and pyloric adhesions were found. There has been complete relief since the second operation.

The sixth patient is a neurotic individual who enjoys ill health. It seems impossible to make her admit that any part of her anatomy functions properly. She probably has a gastrojejunal ulcer.

In the seventh and eighth cases, a gastrojejunal ulcer was excised and the anastomosis disconnected, with complete relief.

The ninth patient suffered from a gastrojejunal ulcer but nevertheless would not allow a second operation to be performed.

The tenth patient with an unsatisfactory result is a little Scotch woman who lives up to all the stoic traditions of her country. Some 10 years ago she was operated upon elsewhere for a duodenal ulcer, and a gastro-enterostomy was performed. She was fairly comfortable for about 6 months when the old gnawing uncomfortable sensation returned. She suffered from this for 8 years. Two years ago we disconnected the gastro-enterostomy and excised a gastrojejunal ulcer. She was fairly comfortable for about 5 months after this and then returned with symptoms and roentgenological findings of a duodenal ulcer. The first ulcer which was duodenal, the second which was gastrojejunal, and the third ulcer which is duodenal and which she now has, have all persisted in the face of the most careful medical management that would be accepted. This patient has refused a third operation.

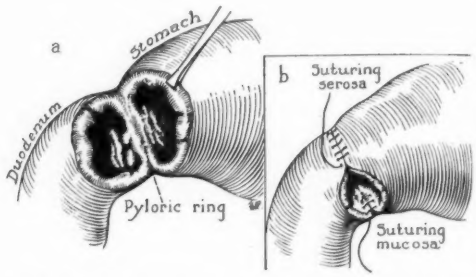

Fig. 5. Judd operation. This type of operation was performed in 7 cases and the results were satisfactory 2 years to 3 months postoperatively.

TABLE I. RESULTS OF ONE HUNDRED AND TWENTY-FIVE OPERATIONS FOR PEPTIC ULCER

No.	Type of operation	Results
1	Sleeve resection	Not satisfactory. Gastro-enterostomy 2 yrs. later, complete gastric relief. Death from cardiorenal break.
2	Horsley	1 satisfactory. 1 stormy convalescence. Final results. satisfactory.
4	Finney	1 satisfactory. 3 stormy convalescence: 1 persistent vomiting, 1 duodenal fistula. Final results satisfactory.
4	Pólya-Balfour	3 satisfactory. 1 syphilitic ulceration and leather-bottle stomach. Died 4 yrs. later of pernicious anæmia.
7	Judd	Satisfactory. 2 yrs. to 3 mos. postoperative.
16	Excision only	50 per cent unsatisfactory.
91	Gastro-enterostomies	4 hospital deaths [4.4%]: 1 from embolism, 14 days; 1 from separation of gastrojejunal anastomosis, 10 days; 1 from pneumonia, 3 days; 1 from postoperative insanity, 16 days. 8 late deaths: 1 from acute appendicitis; 2 from perforating gastrojejunal ulcers; 4 from senility, no stomach symptoms; 1 from cardiorenal break. 79 living: 71 communicated with personally; 8 reported through friends.

The first and second patients each had postoperative hernia but are very comfortable with snug fitting belts and no second operation seems advisable. There have been 3 patients operated

upon with complete relief (the fifth, seventh, and eighth patients), which brings the unsatisfactory results to 5 cases or 6.9 per cent of those living. Of 79 gastro-enterostomies which are functioning satisfactorily and all of which were done from 1 to 10 years ago, gastrojejunal ulcers have been traced in only 6 cases or 7.6 per cent.

TEN CASES, 12.6 PER CENT, NOT ENTIRELY SATISFACTORY

Case 1 and 2 postoperative abdominal hernia. Comfortable with abdominal belt.

Case 3, disconnected on seventh day. Mesentery of transverse colon slipped down over proximal and distal loops of jejunum.

Case 4, disconnected on fourteenth day because of persistent vomiting.

Case 5, pain and discomfort. Operation was done 18 months later. Many periduodenal and pyloric adhesions. Relief.

Case 6, gastrojejunal ulcer, disconnected. Relief.
Case 7, gastrojejunal ulcer, disconnected. Relief.
Case 8, gastrojejunal ulcer, disconnected. No relief.
Case 9, gastrojejunal ulcer.
Case 10, gastrojejunal ulcer.

FIFTEEN PERFORATIONS

There were 4 deaths in 15 cases with perforation. Of these, two patients were operated upon 4 days after perforation, one 8 days after perforation and one a woman 72 years old 6 hours after perforation; of the 15 cases 11 survived.

THE TREATMENT OF POSTOPERATIVE PROGRESSIVE GANGRENOUS INFECTION OF THE SKIN AND SUBCUTANEOUS TISSUE WITH BLOOD FROM IMMUNIZED DONORS

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THE object of this paper is to report a case of an unusual infection of the skin and subcutaneous tissue following incisions for the drainage of an acute breast abscess.

In recent years, this type of lesion has been studied and reported by Frederick Christopher (3), Thomas Cullen (4), Brewer and Meleney (2), and Emory Alexander (1). At the American Surgical Association meeting of 1926, similar cases were reported by Charles A. Porter, of Boston, who referred to 3 cases seen at the Massachusetts General Hospital (5). Alexis V. Moschcowitz, of New York, reported 2 cases that he had seen, and Marshall Clinton, of Buffalo, mentioned 1 case that he had studied. Arthur Marriatt Shipley, of Baltimore, reports a case he had treated at the University Hospital (6). These contributions appear to make up the total recent literature on the subject.

The etiological factors in this type of progressive gangrene are not specific. One fact seems to be most impressive, namely, in each of the cases reported, the patient had been very acutely ill with an infection requiring surgical intervention which was in turn followed by a spreading gangrene.

The organism found in the various cases has varied greatly. The instructive work reported by Meleney (2) discusses the bacteriological findings of their cases in detail. The bacteriological work in our case was done by Downey Harris.

The phrase, "progressive gangrenous infection," describes the lesion most accurately. The first thing to attract attention is an unusual brawny, dark red appearance of the skin surrounding the original site of operation. An accompanying elevation of temperature would seem to indicate that one has to deal with an exacerbation of the original infection. A second incision is made for the sake of better drainage, but its edges are soon undermined and show a tendency to necrosis, sloughing, and gangrene.

The undermined skin is free from the subcutaneous tissue and a purulent secretion exudes from the advancing necrotic area. The edges of the wound bleed very easily but are not noticeably tender. In a variable period of time, extending from several days to 1 or 2 weeks, another area of hyperæmia develops. Another dark purple, discolored border appears and a new advance in the gangrenous field is seen. The hyperæmic area is at first somewhat tender, but not unbearably so. As the gangrene advances, leaving a raw granulating surface, the tenderness associated with this open wound becomes most exquisite. The infection spreads in an even fashion extending around the margins of the wound, first making itself evident in one site and then in another. The entire border of the wound actually becomes a spreading phlegmon.

The patient is not made unusually ill by each flare up of the infection except as the condition

Fig. 1. Sketch showing the area involved.

progresses and covers a larger area of the body. As time passes, however, the signs of secondary anæmia and loss of weight become more and more evident. As the skin is denuded and the subcutaneous tissue sloughs off, the area of granulation tissue becomes increased in size and tenderness, and shows no evidence of epithelization. With the spread of the infection, the discharge becomes most marked and profuse and the odor very offensive. It is extremely interesting to observe the mild virulence and the insidiously persistent spread of this infection, gnawing its way slowly but surely, even eroding, as in our case, the cartilaginous processes of the ribs and sternum (Fig. 2). The organism is absolutely rebellious to any form of treatment used in the treatment of ordinary infections, such as the use of Dakin's solution, mercurochrome, or boric packs. Violet rays, sunlight, and deep X-ray therapy were in our case without beneficial result. After repeated incisions are made and various modes of attack attempted, one commences to realize that surgery and the local use of drugs and rays alone are not the chief factors in conquering this infection. One then begins to think of other means of attack such as foreign proteins, vitamines, blood transfusions, or other body-building agents; or in other words, fighting power to combat the infection.

In the first case reported by Brewer and Meleney, various solutions, X-ray, and light treatments were used to no avail. As a last resort, they circumscribed the entire diseased area by incision through the skin and subcutaneous fat and packed the wound with a solution of 1 per cent formalin changed daily under gas anæsthesia. This seemed to check the infection in this case, and at the end of 13 weeks the patient was discharged cured. In the second case reported by them, the same treatment was carried out as in the first case and the patient was discharged at the end of 11 weeks.

The 3 cases mentioned by Porter were all cured ultimately by radical incision and skin grafting.

The first case reported by Moschcowitz ended fatally after the gamut of all antiseptics and the actual cautery were used. The second case was finally stayed by burning a groove into healthy tissue with the Paquelin cautery. The cautery was also used with apparent success in the case reported by Cullen.

In the case reported by Clinton, a 10 per cent solution of sodium chloride was applied to the margin of ulceration and within a period of 6 days the swollen gangrenous edge subsided leaving a clean healthy ulcer which was followed by skin grafting and quick convalescence.

Dr. Emory seemed to have been successful in the use of a foreign protein in the form of aolan. This case seemed to have burned itself out after persisting for 10 months.

Dr. Shipley conquered the infection in his case by using the electric cautery.

Case 1. Mrs. G. S., 35 years of age, weighing 187 pounds, entered the Jewish Hospital, June 16, 1926. She was irrational and very talkative. Temperature was 105.2 degrees; pulse, 136; respiration, 26; white blood count, 27,700. The patient had noticed some soreness in the right breast for several days. Pus had been coming freely from the nipple for the past 4 days but suddenly ceased on the morning of admission to the hospital. Several hours after the cessation of the discharge, she developed a chill and an elevation of temperature. The patient looked extremely ill and complained of being hungry. Inspection revealed an angry looking right breast with definite fluctuation in the lower outer quadrant.

An incision was made under gas anæsthesia and a large cavity was encountered from which oozed a considerable amount of thick creamy odorless pus. A finger was inserted to make sure that all cavities were broken down; a rubber tissue drain was inserted into depth of cavity; a wet boric pad was applied; and the patient returned to bed in good condition. Culture of the pus showed staphylococcus aureus.

The next morning the patient felt much improved, but the drop in temperature which usually follows the evacuation of an abscess did not occur. During the next 24 hours, the temperature rose to 103 degrees, and the patient continued to have fever ranging from 101 to 104 degrees for several days.

The wound was dressed every 4 hours, wet packs being changed and re-applied. The amount of pus was very profuse. On the fifth postoperative day, the skin surrounding the wound extending over into the lower inner quadrant became red. On the sixth postoperative day, the patient had a severe chill; her temperature rose to 106 degrees;

Fig. 2. Detail drawing of the wound as seen in Figure 1, showing the denuded sternum and rib exposed.

pulse was 132. Lister Tuholske was called in consultation. Thinking that the infection had spread into the other quadrant or that our first attempt at adequate drainage had not been successful, we decided to incise over the newly inflamed area. The patient now looked ill. Gas anæsthesia was again administered and the breast opened at the lower inner quadrant. Pus was evacuated and through-and-through drainage introduced. Culture of the pus showed staphylococcus. Irrigation with Dakin's solution was started. At this period the patient developed a typical postoperative psychosis which caused great concern. She complained constantly of a severe headache accompanied by irregular sieges of chill followed by increase in temperature. The breast was draining freely and we could find no reason, so far as the local condition was concerned, which would cause her to be so ill. Fearing that some other condition might be concomitant with the breast infection, we called Dr. Englebach into consultation.

June 26, no other organic complication was evident. The condition was considered to be due to a postinfection psychosis. The patient was put on luminal and restorative treatment.

June 28, the patient developed a severe chill; lips and nails became cyanotic. A blood culture was negative. Culture from the breast revealed staphylococcus aureus. The patient commenced to complain of a new area of extreme tenderness surrounding the two incisions. The tissue around the old incision looked dark and appeared to be in a gangrenous state. Several other areas in the breast also commenced to look gangrenous. Several days later, these new areas broke down leaving 7 discharging sinuses in the breast.

August 10, Dakin's tubes were placed in each of the sinuses and daily irrigation with freshly prepared Dakin's solution were made. No appreciable progress was made inasmuch as the amount of discharge, temperature, etc., showed no tendency to diminish.

The entire breast now took on an atrophied appearance, the color being dark purple. From each of the sinuses, pus exuded freely. The margins surrounding these openings were undermined and between several of these openings the skin was entirely free from the underlying tissue. The patient was unquestionably losing ground; her temperature ranged from 100 degrees to 102 degrees daily with an occasional exacerbation ushered in by a chill and followed by a rise in temperature to 103 degrees. We knew that this was not an ordinary infection, but in spite of repeated cultures no light could be thrown on the situation.

By August 19, the breast took on such an appearance that it was thought best to do a simple amputation, leaving all margins open so as to allow free drainage. This the patient refused to permit and insisted on leaving the hospital. After staying at home for a week, the patient returned and consented to the simple amputation.

The breast was amputated, August 30, incisions being made wide of all necrotic tissue. The infection at this time did not penetrate beneath the fascia. All margins were left wide open to maintain adequate drainage. Microscopic examination of the breast by Dr. Olch, revealed the following: The specimen, No. 10925, consisted of a breast excised with overlying skin. The nipple was retracted. Over the skin were numerous sinus openings from which thin serous, purulent material exuded. Section of the breast showed 7 different abscesses. One of these extended through the breast and lay upon the pectoral fascia. There was no gross evidence of malignant change. Microscopically, the breast tissue showed a fairly extensive fibrosis. There was a marked round cell infiltration. Abscessed areas were made up of solid masses of inflammatory cells, indicating a progressing mastitis. There was no evidence of malignancy. A diagnosis of chronic suppurative mastitis was made.

Following the removal of the breast, the patient had quite a rise in temperature and the wound drained most freely. However, she had become so extremely sensitive that to irrigate with Dakin's solution was out of the question. Solutions of mercurochrome, saline, and boric were resorted to. Eventually, however, even these had to be discontinued on account of the pain. The wound was left open to the air and periodically baked under incandescent carbon lamps.

September 25, the patient commenced to complain of pain in the area extending down toward the axillary space and it was noticed that the skin there had taken on a red-

Fig. 3 (left). Showing the wound 120 days after the first operation.
Fig. 4. Showing the wound 330 days after the first operation. Skin grafts have been transplanted. The wound margins are in process of closing.

dened appearance. Palpation over this area revealed a new area of tenderness and induration. A probe was inserted and it entered for a distance of 5 centimeters under elevated skin.

October 3. Dr. Evarts Graham saw the patient and advised radical incision of the new area of infection. Dr. O. B. Zeinert concurred in this advice. This operation was performed under gas anæsthesia and the wound was left wide open. The entire area was exposed to the bake, the heat of which was regulated by the ability of the patient to tolerate it. The wound was dressed with vaseline gauze. The secretion was profuse and the tenderness was so extreme that dressing of the wound was almost impossible.

October 16. A new area of redness and tenderness became evident on the mesial side of the involved area, 120 days after the first operation. This area was incised under gas anæsthesia, but no pus was encountered. All of the edges of necrotic tissue were then excised widely and the wound was left open. The condition looked almost hopeless, the wound involving an area 10 centimeters wide extending past the median line anteriorly around past the midaxillary line posteriorly (Fig. 3).

The patient then weighed 106 pounds, having lost 81 pounds in 26 weeks. It was decided on the advice of Drs. Burrows and Schnaeblen to place the patient on a diet rich in certain vitamines, and to try deep roentgen-ray therapy. For several weeks following this new procedure the secretion became somewhat decreased and the wound actually assumed an improved appearance. The granulation tissue became a healthy red and we were joyful over the thought of having found something which seemed to check the infection. However, 3 weeks after the X-ray exposures, the wound began to flare up again. X-ray treatment was again instituted, but it had such a depressing action on the patient's general condition that it had to be discontinued.

Dr. Engman saw the patient on January 14, 1927,and advised spraying the wound with oil to desensitize the area so it could be left open long enough to permit exposure to a violet ray.

Dr. Ganz, of Heidelberg, who happened to be in St. Louis at the time, was called in and he concurred in the open-air treatment, but advised forced feeding in order to try to build up the patient's resistance. This, however, was hard to do because of an obstinate anorexia.

We resorted to transfusion, in spite of the fact that there were only 3,960,000 red blood cells and hæmoglobin was only 65 per cent. Dr. D. L. Harris, pathologist to the Jewish Hospital, who had been working with us throughout the case, suggested the use of immunized blood. His report is as follows:

As repeated examinations of the wound showed the presence in pure culture of staphylococcus aureus, a vaccine was prepared from this organism and beginning March 5, 1927, the patient's husband and stepson were injected with increasing doses every 10 days. Very slight local reactions were noted after the tenth injection, March 27. On March 29, 100 cubic centimeters of blood obtained from the husband was citrated and injected intravenously into the patient. Within less than 10 minutes after the beginning of the transfusion the patient said the wound felt hot and burning. Otherwise, there were no symptoms until 24 hours later when she became nauseated. With husband and son alternating as donors, transfusions of 100 cubic centimeters each were given on March 29, April 5, April 13, April 21, April 28, and May 9. During every transfusion the patient complained of a burning over the wound within 10 minutes of the beginning of the injection of the blood. No other reaction was noted, until the fifth transfusion on April 28, when the patient complained of a slight respiratory oppression while the blood was being given.

During the transfusion on May 9, the patient's breathing became distinctly labored, with frequent sighing and the transfusion was stopped when only 70 cubic centimeters of blood had been given. As the two last transfusions had been accompanied by symptoms of sensitization, it was thought advisable not to give any more blood unless the healing process should show signs of retrogression.

Within 2 weeks after the first injection the improvement in the appearance of the wound was astonishing. The secretion became less; the undermined advancing edges became attached to underlying tissue, and a closing-in process became unmistakably noticeable. Local treatment

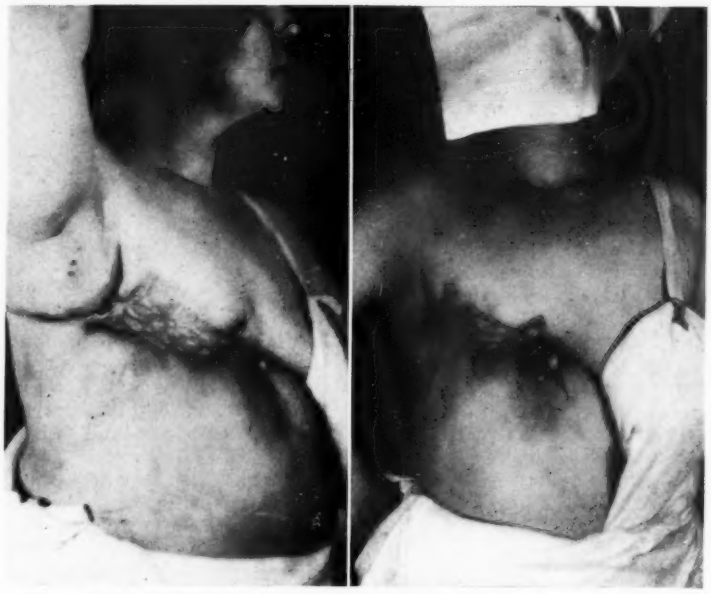

Fig. 5 (left). Showing the wound 400 days after the first operation. The entire area is healed except close to the axilla where accessory mammary glands form a mechanical impediment

Fig. 6. Showing the appearance of the wound 18 months after the onset of the infection. An area of osteomyelitis is seen over the sternum.

consisted in keeping the wound clean and applying plain vaseline dressings which could now be done with less discomfort to the patient.

May 5, the wound margins were commencing to fill in. The secretion was much less and the patient had gained 3 pounds in weight. May 19, 10 pinch grafts from the thigh were transplanted to the wound under local anæsthesia and in 10 days it was evident that all had taken (Fig. 4). On May 30, 35 pinch grafts were taken from the thigh and placed on the wound. All but 6 took.

June 1 was the first day since the onset of the infection that the patient passed through 24 hours with a normal temperature. On July 5, the entire wound had become covered and healed except for an area where the infection had eroded the sternum and caused an osteomyelitis, and another area close to the axilla where an accessory mammary gland formed a mechanical impediment to the complete healing (Fig. 5). The patient was discharged on July 10, after having spent almost 370 days in the hospital.

June 1, 1928, the patient's general condition was very good. She weighed 165 pounds and was considering going into business. The wound was practically healed save for a clean granulating area the size of a thumb which still persisted where the mammary gland interfered with complete healing. This we felt would have to be dealt with by plastic surgery at a later date. A small amount of discharge was seen to come forth from the old area of osteomyelitis in the sternum (Fig. 6).

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INTESTINAL KINKING

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An endeavor will be made in this paper to show by experiment both with tubes other than intestine and with intestine at the autopsy table that intestinal kinking has a definite etiology on which can be based definite prophylactic and therapeutic measures.

Search of the literature reveals nothing on the mode of production of this phenomenon (except the doubtful Lane's kink) but does show that the English surgeon, Rowlands, previously expressed the writer's clinical views that "intestinal obstruction due to kinking occurs following operations, and during peritonitis, where it is mistakenly called paralytic distention of the bowel."

In the writer's opinion paralytic ileus as a surgical entity does not exist, as only the transient intestinal inhibition following peritoneal insult, or the last state of an obstructed bowel, is of this nature. During the period of inhibition, more prolonged in case of peritonitis, gas is produced and this inflates the bowel which, as will be shown later, causes it to kink. Were the bowel not kinked the gas would immediately escape through the rectal tube. Gas pains—the beginning of postoperative symptoms—are due in the writer's opinion, to *recovered* bowel contracting against obstructing kinks. Having consulted scientific friends in a fruitless search for information on kinking in tubes, the writer has developed the following conception himself.

Kinking is a phenomenon in which the circumference of a tube tends to flatten to a plane when the tube is bent through the arc of a circle. It can best be understood in its simplest form by taking a half tube of *inelastic* material such as paper (Fig. 1A). It will be seen that *AB* and *CD* are of equal lengths. If this half tube be bent into a circle, it will be seen that *AB* and *CD* form circles of equal circumferences and therefore *EF* becomes a straight line. If we make this half tube into the arc of any circle, no matter how large, *EF* becomes a straight line. If now we take a complete tube (Fig. 1C) and attempt to bend it so that the zone *EF* forms the arc of any circle whatever, *the two hemicircumferences straighten out into two straight lines and a kink is formed.* Let us call the line *EF* the *approximation line* of a kink, the convex part of the tube wall over the kink, the *cap;* the under part of the kink the *angle,* and the double walled partition formed by contact of the limbs of the kink when the angle is acute the *spur.* The cap at *EF* is held down on top of the spur by the resultant of the forces which made the bend, thereby forcibly occluding the lumen of the tube.

FACTORS FAVORING KINKING

The less elastic the tube the more readily it kinks. If we take an elastic or ductile tube we find it can be bent to a certain extent without kinking, as its outer circumference can elongate. It will be seen (Fig. 2B) that *AB* becomes longer than *CD.* Once the limit of elasticity is reached kinking occurs (Fig. 2C). This can be applied at once to the human bowel. Intestine with its wall stretched by dilatation, covered with fibrinous exudate, or infiltrated with intramural inflammatory products has its elasticity impaired and kinks readily.

The larger the tube the more readily it kinks. This axiom is extremely important for on it the pathogenesis of intestinal kinking largely depends. If we take a large and a small tube and bend them, we find that the large one kinks when slightly bent but the small one may be made into a very small circle without kinking. Plumbers make use of this axiom in choosing a smaller pipe to make a difficult bend. Plumbing catalogues specify how far their pipes can be bent without "buckling"—smaller sizes bending much further. Collapsed bowel will lie in very small coils without kinking but if the intestinal tube is enlarged by air inflation, it readily kinks when held in circles the maximum diameter of which is the inside of the abdomen and the maximum radius of which is the length of the mesentery.

A kink may be *complete* or *incomplete* depending on whether or not the cap is in complete contact with the spur. It may be *free,* or have its limbs *fixed* together with fibrinous exudate, or *held* by the margins of an aperture, between transperitoneal bands, etc.

The normal intestine lies in a series of incomplete free kinks. If the intestinal diameter is increased with gas distention, these kinks may become complete and form a series of resistance-offering obstacles the sum total of which is obstruction. As a rule the obstruction due to free kinks is not serious, responds readily to treatment, and the kinks disappear with the distention. In herbivorous animals, however, it is

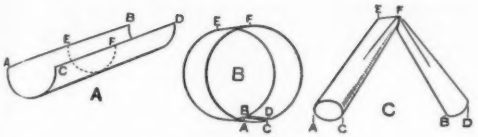

Fig. 1. Kinking analyzed.

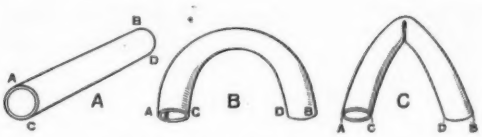

Fig. 2. Kinking in an elastic tube.

frequently so serious as to require trocar enterostomy, and it has been reported by Hunt so severe after kidney operations as to require cæcostomy.

OBSTRUCTION IN KINKS

Factors favoring obstruction in kinks may be conveniently studied with a length of thin-walled cigarette drain tubing with one end clamped and an atomizer bulb tied into the other. If the tube is merely rounded out with air, it kinks readily. Because of the transparency of the cap, the spur can be readily seen. With further pressure by the atomizer bulb, *the proximal limb of the kink distends* slightly, then the approximation line which has been straight is seen to arch up in the center and the gas passes the kink. Any factor, therefore, which will prevent the upward rising of the cap will make the kink more obstructive. Holding the approximation line against the wall makes it totally obstructive. It is highly possible for this to occur in the pelvis. Loss of elasticity at the cap will also keep it from rising. This might result from the stretching of the wall to its limit, or from adherent exudate. A kink in a garden hose (traction kink) is totally obstructive at once because of the inelasticity of the wall of the tube.

PRACTICAL APPLICATION

Gas formation. The diameter of the intestinal tube is kept down by preventing the formation of gas. For the first 36 hours after laparotomy, patients receive warm water only by mouth, then if there is no distention they receive full fluid diet. If there is any tendency to distention, however, the patients are given acidophilus milk until the tendency has disappeared. The great value of acidophilus milk was impressed on the writer several years ago by the following case.

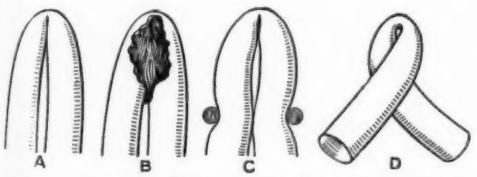

Fig. 3. Varieties of kink. A, free kink; B, fixed kink; C, held kink; D, traction kink (garden hose kink, of doubtful occurrence in the intestine).

CASE 1. A farmer was admitted to the hospital 5 days after the onset of acute appendicitis. The abdomen was a mess of pus and fibrinous exudate, so that drainage alone was established. Distention set in and increased in spite of frequent doses of pituitrin, after which the patient passed much flatus. Finally, on the fourteenth day, I re-opened the abdomen. The peritonitis had cleared up but the small bowel was 3 inches in diameter and showed several kinks, firmly fixed by fibrinous exudate beginning to organize. The bowel was about the same size on each side of these kinks so they were not completely obstructive. They were freed and the abdomen was closed. The patient was in excellent condition for about a week. After that distention set in again and increased until he was as ill as before, with the abdomen greatly distended and tense. Pituitrin still caused some flatus to pass. I reasoned that if we could check intestinal gas formation we might save him. Acidophilus milk was tried with a most spectacular result. In 24 hours the abdomen was flat and patient made an uneventful recovery.

Since then I have given acidophilus milk for several days preparatory to laparotomy. A local dairy makes the milk and patients drink it at home before they enter the hospital. It has worked admirably as a distention preventive. One case in particular in which prevention of distention was very essential illustrated its value—a large ventral hernia which was repaired with living suture fascial transplants. The abdomen with its returned bowel remained absolutely flat and soft.

Thomson-Walker and Everidge use the intestinal antiseptic dimol preparatory to kidney operations to prevent distention.

Intraperitoneal exudate. Wound exudate, especially in the pelvis, cements loops together

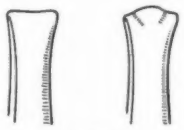

Fig. 4. Kink at rest and kink with gas passing.

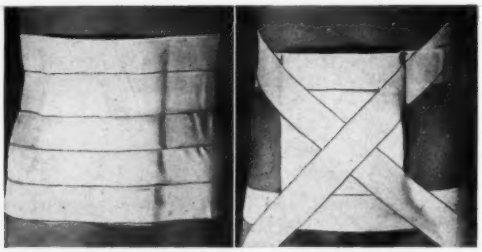

Fig. 5. (left) A kink-favoring type of dressing.
Fig. 6. Anti-kink dressing.

and forms fixed kinks—the common, dangerous variety. Therefore, great care should be taken to peritonealize raw surfaces and cover them with omentum. The prompt stamping out of peritonitis with intraperitoneal antiseptics and the raising of the patient's resistance with blood transfusion and ultra-violet light baths are also important.

The dilated intestinal coils should be left free to form arcs of the largest possible circles. Avoid tight postoperative dressings. The pelvis, as it is the smallest circle in the abdomen, must be watched closely as it is a danger zone for kinking. If loops, which lie there flaccidly at autopsy, are held down with a hand over the pelvic brim, and inflated with air, they are bound to kink. Loops held in the pelvis by pressure from above or by exudate from intrapelvic surgical wounds are sure to kink if only moderate distention occurs. In the writer's opinion the most likely explanation of Handley's "Ileus Duplex," is pelvic kinking and not the fact that the bowel is lying in a pelvic pool of pus as frequently happens with infrequent seriousness. In this connection a popular type of postoperative dressing in which strips of adhesive stretch tightly across the lower abdomen from one iliac crest to the other is not above reproach.

The writer now uses no transverse strips across the lower abdomen, but holds the lower end of the gauze dressing with a strip which runs from trochanter to trochanter (Fig. 6) and crosses at the symphysis and not over the pelvic brim. The upper transverse strip is very loosely applied. The adhesive is cut along *AB* 6 hours after operation and loosely taped.

If the gas is blown past the kinks early, the kinks will tend to disappear. The writer uses pituitrin[1] freely and early even in intestinal cases, believing that a "blow out" at an intestinal suture line is less liable to occur from pituitrin on a comparatively healthy bowel than from constant pressure

[1] B. and W. infundin.

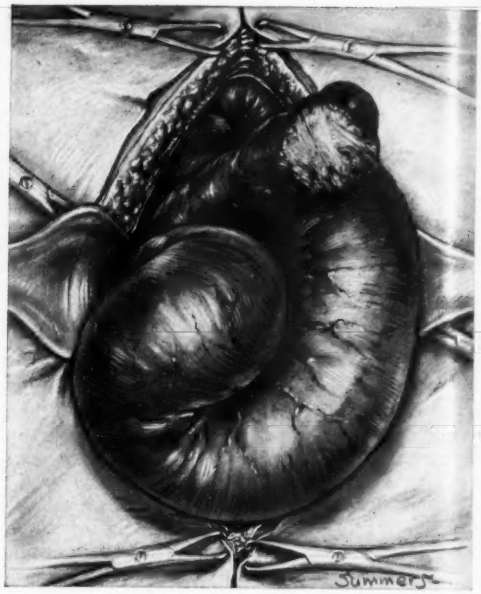

Fig. 7. An obstructive fixed kink found at consultation relaparotomy following removal of an ovarian cyst. This kink allowed gas passage with pituitrin.

of kink-locked gas on a bowel wall rendered anæmic from the pressure.

CASE 2. An emergency colon resection with end-to-side of ileum to mid-transverse began to distend 36 hours after operation. The anti-kink dressing had been so cut that the abdomen was free to expand. The patient was given 4 doses of infundin, ½ cubic centimeter each, at five minute intervals and passed much flatus through the rectal tube. Three grains of calomel was given by mouth and acidophilus milk was started. With the assistance finally of another dose of infundin there was a good bowel movement from the calomel and the abdomen remained soft and flat.

SERIOUS CASES

If symptoms persist after initial treatment with infundin, gastric lavage with small tube, colon irrigation, and acidophilus milk, a fixed kink is probably present. Unequal abdominal distention, clear return from a colon irrigation, or malodorous vomiting are indications for interference even though some flatus be passing. Catheter jejunostomy as a first stage should be seriously considered as these cases are poisoned and with all our modern supportive measures often resuscitate poorly after relaparotomy. It is not quite the life

saver we had hoped, however, as kinks in peritonitis cases may be multiple and the catheter drain a limited segment of bowel. Sampson Handley recommends the heroic procedure of draining the jejunum into the transverse colon by anastomosis and draining the colon by a cæcostomy. Late cases of this type are yet a little beyond our present efforts and challenge further research into the intestinal toxins which make them such bad risks for relaparotomy.

SUMMARY

While there may have been a transient upset of intestinal physiology, kinking and not paralytic ileus is the pathology of ordinary postoperative gas pains, distention, and obstruction.

The occurrence of kinking can be rendered less likely by keeping down the intestinal caliber by diminishing gas production with acidophilus milk; by applying loose postoperative dressings, especially over the pelvis; and by eliminating early the gas formed during the period of inhibition. When interference is imperative, the question of doing a catheter enterostomy previous to obstruction-relieving relaparotomy should be seriously considered.

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THE CURE OF AN INTRACTABLE VESICOVAGINAL FISTULA BY THE USE OF A PEDICLED MUSCLE FLAP

A New Concept

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THE earliest pages of medical history give proof of the fact that the subject of vesicovaginal fistula has always merited considerable attention on the part of surgeons. Hippocrates made mention of the fact that it was a relatively common condition and due, usually, to a protracted labor. From that time on, while the subject received considerable discussion, nothing definite regarding the possibility of obtaining a cure was brought forth until 1663 when Van Roonhuysen of Amsterdam suggested the use of sutures as a means of closing such a fistula. The next important advance was made by Jobert in the early part of the nineteenth century. He suggested and practiced the transplantation of the labium of one side to be placed into the fistulous opening as a plug. Agnew, in describing his method, says, "The circumference of the fistula, being drawn down, was freshened, a flap was raised from the inner surface of the labium, and, being turned into the opening, was secured by a number of stitches; a catheter was kept constantly in the bladder during the treatment. In one case the growth of hair, the follicles of which were in the flap, induced a vaginitis."

Next came the important contribution of J. Marion Sims. This consisted of the following:

1. The use of a speculum which permitted of thorough exploration and ready accessibility to the fistula.

2. The introduction of a suture which would remain a long time without inducing either irritation or ulceration.

3. The introduction of the indwelling catheter.

Following the publication of this work, the incidence of cases cured by operation rose very rapidly. Numerous modifications were offered, notably by Agnew. But all, in the final analysis, embodied the same principles. In 1873, Agnew reported 60 cases with 3 deaths and 5 failures, certainly a remarkable record.

Mackenrodt, in 1894, made the next notable advance. He recommended the separation of the vesical and vaginal walls from each other, isola-

Fig. 1. The condition on admission to the hospital. The fistula is situated at the junction of the urethra and bladder and measures ¾ of an inch in diameter.

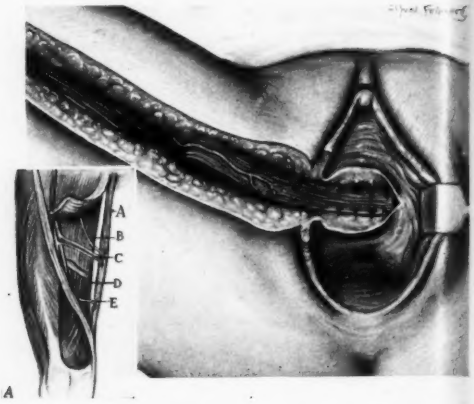

Fig. 3. A further stage in the operative procedure. The gracilis muscle has been turned upon itself and placed across the base of the bladder and anchored by interrupted sutures. It indicates the blood supply intact. Insert shows the anatomy of the gracilis muscle. *A*, Gracilis muscle; *B*, upper nerve; *C*, blood supply; *D*, divided adducter longus muscle; *E*, lower nerve supply. In this operation, the upper and lower nerves were divided.

tion, and closure of the fistula, and then separate suture of the vaginal mucosa. This was indeed a great improvement over Sims' method of inversion suture of bladder and vaginal walls combined. The final conception of the repair processes involved in the closure of these fistulæ was reached

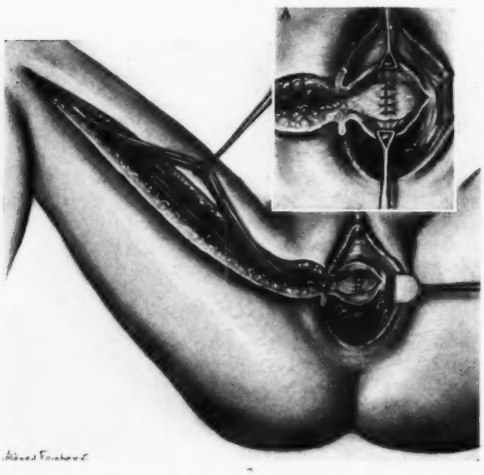

Fig. 2. Two steps in the operation. The anterior and posterior vaginal flaps have been fashioned. The bladder has been mobilized and the fistulous opening closed in two layers. Insert shows the details of this procedure. The drawing also indicates the incision on the mesial aspect of the thigh which has been made continuous with the vaginal incision by cutting across the right side of the vulva. The gracilis muscle has been isolated and retracted.

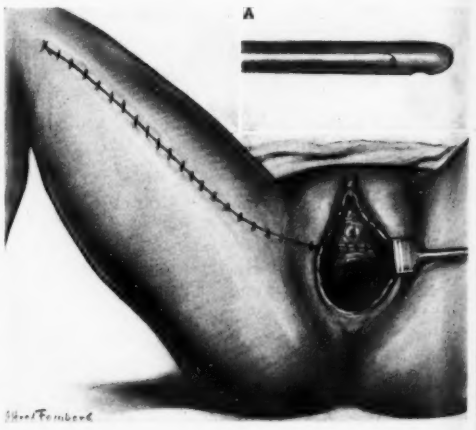

Fig. 4. The completed operation with the thigh, vulvar, and vaginal wounds repaired. In the anterior wall of the vagina may be seen a bulge indicating the position of the underlying gracilis muscle. Insert shows the double catheter arrangement used for continuous intravesical suction. The outer catheter is a No. 18 F., and the inner catheter is a No. 12 F. It will be noted that the inner catheter is ¾ of an inch from the end of the outer one. It was placed so as to prevent the pulling in of the bladder mucosa by the suction.

when it was realized, in the early part of the twentieth century, that, in addition to Mackenrodt's principle, it was necessary to mobilize the bladder extensively before a cure could be regularly expected.

This, then, brings us to the situation at the present time. Most surgeons are agreed now that the operative cure of vesicovaginal fistula is dependent upon the following factors:

1. Fashioning of vaginal flaps, the bladder wall being thus separated from the vagina.
2. Inversion of the fistulous opening by rows of sutures.
3. Extensive mobilization of the bladder. In this regard, Watkins' recommendation for mobilization as far as the broad ligament attachments is probably too radical and unnecessary.
4. In high fistulæ, the use of the incision recommended by Schuschardt whereby greater accessibility to the deeper recesses of the vagina is obtained. This step applies particularly to fistulæ following hysterectomy.
5. Approximation of the vaginal flaps over the repaired bladder in such a way as to place the suture line at some distance from the suture line in the bladder wall.
6. The use of an indwelling catheter. In this connection it is interesting to note that Sturmdorf reported in 1925 a case of fistula cured by his tracheloplastic operation following which no bladder drainage was used. Incidentally, in cases in which the fistula is situated near the cervix, the procedure carried out by him should merit serious consideration.
7. Careful postoperative care aimed at the prevention of cystitis.

Apparently, a combination of two factors favors repair: mobilization allows the bladder to contract and thus to diminish the size of the opening, at the same time lessening tension on the suture line, and mobilization also favors the gliding and displacement of tissue planes one upon another, so that broad raw areas come into apposition.

A study of the literature indicates that the acceptance and practice of these principles results in cure in the majority of instances. However, not uncommonly a case will not respond to this form of treatment and recurrences develop; operations are performed again and again and still the fistula recurs. One author reports eighteen operations on one patient without obtaining a cure. Barring the presence of constitutional disease, the cause for each recurrence seems to be a local one. The base of the bladder soon becomes converted into dense scar tissue of great vulnerability and the vaginal mucosa becomes markedly atrophied. Each operative attempt at cure causes more tissue slough and a vicious circle is established. In the past, heroic measures have been adopted by surgeons to afford these patients some relief from a most distressing disease. These have ranged from suprapubic cystotomy to obliteration of the vagina distal to the fistula, adding thereby a vaginal pouch to the bladder, and even implantation of the ureters into the rectum by the Coffey operation.

Such a case came under our care a year ago. Three well-planned and well-executed operations had been performed in an attempt to cure a fistula situated near the vesical neck. After each operation, the fistula recurred while the patient was still in the hospital. After the last operation, the fistula measured ¾ of an inch in diameter and involved part of the urethra. The bladder was markedly contracted and its base was converted into dense scar tissue, fully ⅜ of an inch in thickness. The vaginal mucosa was atrophic and lined by encrusted urinary salts. It was evident that this problem had to be approached from a different standpoint than ordinarily considered in the treatment of vesicovaginal fistula.

It was finally decided that three factors had to be considered and they proved to be of the greatest importance in effecting a cure:

1. The use of an atraumatic technique in the performance of the operation. The importance of this point has been repeatedly stressed in our work in tendon surgery. (See *Annals of Surgery*, January, 1926, and January, 1927.)
2. The interposition between bladder and vaginal mucosa of a layer of normal tissue of good blood supply and of known resistance to infection. In other forms of surgery, such tissue has been exemplified in a pedunculated flap of muscle. A fascial flap was considered but was discarded because of its thinness and its susceptibility to infection.
3. The use of continuous intravesical suction carried out through a retention catheter, in order to keep the bladder dry at all times.

The history of this case is reported in detail because it is felt that the operation described offers a different concept of the repair processes in the cure of intractable vesicovaginal fistulæ, and opens up a wide field in the future development of this type of surgery.

Case Report. Mrs. C. B., aged 44 years; American; married; was admitted to the hospital in April, 1927, for the repair of a recurrent vesicovaginal fistula. She had had four full term pregnancies. Each labor had been noted as being very easy. She had also had four abortions, three of which had been induced. In her past history, the following important facts were determined: On October 28, 1918, a

left salpingectomy was performed for ruptured ectopic pregnancy, following which convalescence was uneventful. On March 7, 1921, a right salpingectomy was done for a ruptured ectopic pregnancy. Following this operation, convalescence was again uneventful. In July, 1922, the patient was operated upon for a cystocele. Previous to this, she had been complaining of incontinence of urine which had become progressively worse since a miscarriage 18 years before. The incontinence was not absolute, but was worse when the patient was up and about and tired. Operation consisted of an anterior colporrhaphy and amputation of the cervix. Two days later, a discharge of urine from the vagina was noted. In spite of local treatment, the fistula persisted.

Upon her admission to the hospital in May, 1923, examination showed a vesicovaginal fistula situated at the neck of the bladder, measuring 2 by 1 centimeters. The operation done consisted of the dissection of vaginal flaps, mobilization of the bladder well up on each side, excision of the fistulous opening, and repair by inversion of the mucous membrane and bladder wall, in two layers. The vaginal mucosa was then sutured separately. An indwelling catheter was placed in the bladder and the patient was turned over on her abdomen for a period of 2 weeks. The fistula soon recurred.

She was readmitted for a second repair October 24, 1923. At this time, the fistula was 5 millimeters in diameter. At operation, an elliptical incision was made in the mucous membrane and the flaps dissected backward. The bladder was well mobilized again. Four silk sutures were then placed from within the bladder through the edges of the fistula and tied, their ends being brought out through the urethra, the edges in this way being inverted. The pelvic fascia was brought across the base of the bladder and united with chromic catgut. The vaginal flaps were closed with silk. A self-retaining catheter was placed in the bladder and the patient turned face downward for a period of 10 days. The fistula recurred while the patient was in the hospital.

The patient was readmitted for a third attempt at closure in April, 1924. First, a suprapubic cystotomy was performed. On May 5, 1924, an operation for the repair of the fistula was done. A curved incision was made across the anterior wall of the vagina with the convexity forward, the edge of the fistula being excised. A flap of vaginal mucosa was dissected backward until it could be mobilized and brought forward as far as the urethral orifice. The urethra was split along its posterior surface up to the fistula. The mucous membrane was sutured with chromic catgut from behind forward, and an attempt was made to repair the sphincter. The posterior vaginal flap was then brought forward and sutured to the edge of the meatus, in the hope that, if the fistula recurred, it would be oblique and above the meatus. Moreover, it was thought that by deflecting the fistula to a more anterior position, the subsequent repair would be easier in the event that the fistula recurred. It did recur while the patient was in the hospital.

When the patient came under our care in April 1927, examination showed a urethrovesicovaginal fistula, measuring ¾ of an inch in diameter. The bladder was greatly contracted and its base was replaced by dense scar tissue measuring ⅜ of an inch in thickness. The vaginal mucosa was thin, atrophic, and bled easily. The vagina was lined by encrusted urinary salts (Fig. 1).

We were here confronted with a two-fold proposition. In the first place, it was necessary to close the fistulous opening and, secondly, the repair of the divided sphincter had to be considered. For two weeks prior to the operation, the vagina was carefully prepared by daily douches helped by intermittent suction, and the bladder was irrigated daily with acriflavine solution. On April 26, 1927, the following operation was performed:

A transverse incision was made in the anterior vaginal wall on a line with the fistula (Fig. 2). A large posterior flap of vaginal mucosa was dissected backward with great difficulty because of the dense scar tissue. A smaller anterior flap of mucosa was likewise fashioned, the fistulous opening and the urethra being thus exposed. Two structures which were thought represented the divided ends of the sphincter were repaired with interrupted stitches of fine chromic catgut. The base of the bladder was then mobilized well outward on both sides, and the fistulous opening closed with interrupted mattress sutures of chromic catgut in two layers (Fig. 2A).

After changing gloves, gowns, etc., and redraping the patient, a longitudinal incision was made on the medial aspect of the right thigh, exposing the gracilis muscle (Fig. 2). Its lower nerve supply was divided and the muscle was cut across near its insertion. It was then turned upon itself, dividing its upper nerve supply but leaving its upper blood supply intact. The major portion of the incision in the thigh was closed with chromic catgut for the fascia and silk for the skin. The upper extremity of the thigh incision was then made continuous with the incision in the vagina by cutting across the vulva transversely. The gracilis muscle was then placed transversely across the base of the bladder over the repaired fistula, and held in position by interrupted stitches of fine chromic catgut (Fig. 3). The vaginal mucosa was then sutured over the muscle with interrupted chromic catgut stitches and the remainder of the thigh wound and vulva repaired (Fig. 4). The bladder was washed out with saline and an indwelling double catheter (Fig. 4A) inserted. The vagina was packed tightly with iodoform gauze. In order to immobilize the thighs, a triangular-shaped molded plaster splint was placed between the thighs, in such a way as to separate the knees. The apex of this splint pointed toward the vulva.

The inner tube of the indwelling catheter was connected with a suction apparatus. The inner extremity of this inner tube was situated at a point ¾ of an inch from the inner end of the outer tube. This was done to prevent the pulling in of the bladder mucosa by the force of the suction.

The postoperative care of this patient was tedious and it was necessary to attach the greatest importance to the minutest details. It was found that the inner catheter had to be changed every 48 hours to insure continuous suction. This intravesical suction was maintained for a period of 24 days. On the fourth day after operation, the patient was taken to the operating room and the vaginal packing was removed. The anterior half of the posterior vaginal flap was found to be sloughing. The muscle, however, was intact and apparently united to the bladder. There was no leakage. Following this, the patient was dressed every other day in the operating room, the treatment consisting of irrigation of the bladder with acriflavine solution, prolonged vaginal douche, repacking of the vagina and readjustment of the indwelling catheters. The immobilizing splint was maintained for a period of 24 days.

A superficial infection developed in the middle of the thigh wound, but this soon cleared up. There was considerable œdema of the lower half of the divided right vulva. This was thought to be due to a vascular change incident to its division into two parts. This œdema soon subsided.

On the day that the suction apparatus was removed, May 20, 1927, there was no evidence of any leakage and the patient voided voluntarily about every 2 hours, the quantity at each voiding measuring 2 to 4 ounces. This voluntary control continued while the patient remained in bed. She was allowed out of bed on May 26, 1927. On this day, it was noted that there was less control of the bladder and a little spilling occurred through the urethra. She was discharged from the hospital June 5, 1927. Following her return home, she developed a mild phlebitis of the right femoral vein. This subsided after about 3 weeks.

At the present time, the situation is as follows: the wounds are healed. When the patient lies down, she has complete control of the bladder, so that upon arising she is able to void satisfactorily. When she is up and about for any length of time and becomes tired, there is not infrequently a discharge of urine through the urethra. She states that, at times, she feels she is able to contract the tissues around the neck of the bladder and thus control the outflow of urine. This, however, requires considerable effort. Examination at the present time shows the following: the thigh wound is firmly healed and there is no impairment of motion as a result of the transplantation of the gracilis muscle. The right half of the vulva is slightly deformed. The urethral orifice is somewhat patulous and easily admits a No. 20 F. catheter. In the recumbent position, there is no leakage of urine. Stretching across the base of the bladder is felt a ridge of soft tissue measuring about 2 inches in its anteroposterior diameter and extending from the right to the left side of the base of the bladder. The vaginal mucosa is smooth and glistening. The patient feels that she has been considerably improved by the operative procedure.

It is felt that the limit of improvement as regards voluntary control, has not as yet been reached.

SUMMARY

A case is reported of the cure of a large urethrovesicovaginal fistula by the utilization of a pedunculated muscle flap taken from the inner side of a thigh in the form of the gracilis muscle. In addition, use was made of continued intravesical suction extending over a period of 24 days without any evidence of vesical infection. It is felt that the findings presented constitute a new and additional concept in the management of cases of intractable vesicovaginal fistula.

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RESECTION OF THE CÆCUM AND ASCENDING COLON

How the Mortality May Be Reduced by Modification of the Usual Operation[1]

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EXCLUSIVE of the rectum, the parts of the colon most frequently involved in malignant disease are the two most mobile portions; namely, the cæcum and the sigmoid. In a large series of cases studied by Judd (3), the incidence was as follows: cæcum and ascending colon, 159; hepatic flexure, 29; splenic flexure, 24; descending colon, 46; transverse colon, 75; and sigmoid flexure, 292. Thus, in 25 per cent either the cæcum or ascending colon was involved.

Nearly all authorities are agreed that the proper treatment in operable cases of carcinoma originating in the cæcum or lower portion of the ascending colon is resection of the entire ileocæcal coil of intestine as high as the distribution of the middle colic artery, accompanied by an anastomosis between the ileum and the transverse colon or some other short-circuiting operation. Without surgical intervention, cancer of the cæcum inevitably gives rise to early intestinal obstruction. Although attended with a high mortality, resection of the cæcum prolongs life and the patient may pass his last days in relative comfort.

Charles Mayo and Hendricks (5) report that of 257 patients with carcinoma of the right segment of the colon subjected to operation during a 10-year period, 141 are known to be dead, 34 cannot be traced, 55 lived from 1 to 4 years; 25 lived from 6 to 8 years; and 12 are alive from 8 to 9 years after operation.

Considering the gravity of the disease for which the operation is performed, we find the end-results of resection of the cæcum and ascending colon comparatively good except for the high immediate mortality, which is said to vary from 15 to 45 per cent. The situation has been well stated by Judd (4), of the Mayo Clinic, as follows: "The immediate results from operating for cancer of the colon have been rather unsatisfactory, and the mortality is altogether too high. On the other hand, the ultimate results in patients surviving operation have been very satisfactory as compared with operation for cancer in other regions, so that, if we can develop some standard technique for the operation of cancer of the colon, the ultimate results will be very successful. There are several types of operation. The ideal operation is resection in one stage with anastomosis."

Aside from malignant disease, the most important indications for ileocæcal resection are tuberculosis of the cæcum and chronic ileocolic intussusception.

MEASURES ADVISED TO LOWER MORTALITY

Crile (2) has employed the following technique in an attempt to lower the mortality from resection of portions of the colon: A two-stage operation is preferred, and the fæcal stream is short-circuited to exclude the field of operation. An iodoform gauze pack is used to prevent contamination of raw surfaces and protect the retroperitoneal space against infection. Crile resorts to wide resection to prevent recurrence and employs radium and deep roentgen-ray therapy.

Rankin (6) advises resection of the ascending colon and end-to-end anastomosis with a Murphy button. Two points of suspension are selected: one at the head of the cæcum, the other at the point on the transverse colon where the ileum is to be anastomosed. In freeing the cæcum, one should not attempt a "digging" operation. While mobilizing the upper angle of the ascending colon, the operator must be careful to avoid injury to the retroperitoneal duodenum. Rankin restores the continuity of the intestinal lumen by open end-to-end anastomosis between the ileum and the colon or by end-to-side anastomosis. He prefers the former technique and uses two layers of tannic acid catgut in the anastomosis. The first suture unites the mucous coats of the bowel; the second layer, the serosa. After the mucous stitch has been put in, the lumen of the bowel is held open by blind introduction of the thumb and forefinger.

When complete cancerous obstruction of the colon is allowed to develop, the patient necessarily suffers severe toxæmia and is rarely able to survive an extensive operation. Even without complete obstruction, infection is the most important cause of the mortality from the customary operation of resection of the ascending colon and intestinal anastomosis. If the suturing should be imperfect or there should happen to be a poorly anastomosing circulation in the sutured ends of the intestine, intestinal leakage is very likely to occur and cause peritonitis.

[1] Condensed report read before The Sydenham Hospital Clinical Society, New York, October 18, 1927.

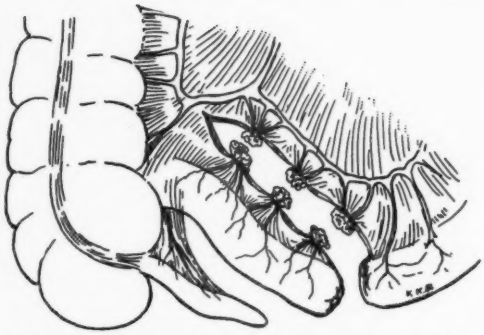

Fig. 1. The two cut ends of the ileum are secured by a purse-string suture. The mesentery of the small intestine is separated.

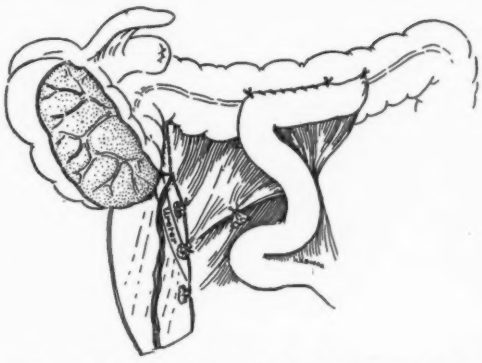

Fig. 2. Upon completion of the lateral isoperistaltic anastomosis between the proximal end of the ileum and the middle of the transverse colon, the resection of the cæcum and ascending colon is started.

The shock of operation, too, is necessarily considerable. Should the anæsthetist report danger during the resection of the cæcum, the surgeon must nevertheless continue the operation, at least to the extent of performing an intestinal anastomosis. To be sure, should the condition be very alarming, he may order the anæsthesia stopped and leave an ileal fistula. But ileal fistula produces such unfavorable effects that it should be avoided whenever possible. It would seem desirable, therefore, to modify the usual operation to the extent of removing the danger of fæcal contamination and devising an operation that may be interrupted if necessary at any time.

ADVANTAGES OF REVERSING OPERATIVE STEPS

By a simple expedient, I believe that I have been able to eliminate the most objectionable features conducive to the high mortality from resection of the cæcum; that is, by reversing the usual procedure and first performing intestinal anastomosis and then excision of the diseased colon. A one-stage operation is still used, although it may immediately be converted into a two-stage procedure should occasion demand.

What are the advantages of the reversed procedure with regard to the danger of infection? The colon is a heavily contaminated area. As soon as it is opened, the danger becomes great. With perfect technique, it is possible to effect a completely aseptic anastomosis between the ileum and the transverse colon; but the extensive manipulation and excision required in connection with the mobilization and resection of the cæcum are bound to result in more or less leakage. Especially is this the case when the intestinal current has not already been short-circuited; for peristalsis is not completely inhibited even when the intestines are exposed and the fæcal contents tend to exercise some degree of pressure against clamps and sutures of the area to be resected.

If the anastomosis has already been established, the natural current of the fæcal matter toward the sigmoid flexure is not molested; therefore, the pressure against the area being resected is appreciably lessened, and the degree of contamination is thus definitely diminished.

Another important fact is that, when the procedure that I advocate is followed, such contamination as takes place from resection of the cæcum occurs at the close of the operation; whereas, when the usual method is adhered to, infection is more likely to occur early in the operation. While the delicate work required for the anastomosis between the ileum and the transverse colon is being done, there is no breach of asepsis. Such contamination as necessarily results from extensive resections of the cæcum may be handled adequately by suitable drainage. In the great majority of cases no drainage is required. It is only when asepsis has been imperfect or the retroperitoneal space cannot be closed that I consider this precaution necessary.

A theoretical advantage of some importance is the fact that the fæcal current is not interrupted during the course of the operation; for, when the cæcum is clamped off preparatory to its resection, a short-circuit of the fæcal stream has already been established. When the cæcum is excised first, a temporary artificial intestinal obstruction is produced from the moment when the clamps are first applied to the segment to be removed, and it lasts until the anastomosis is completed. There is good reason to believe that such

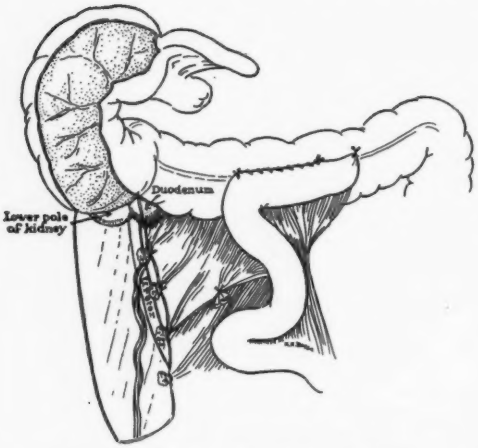

Fig. 3. Separation of colon to hepatic flexure.

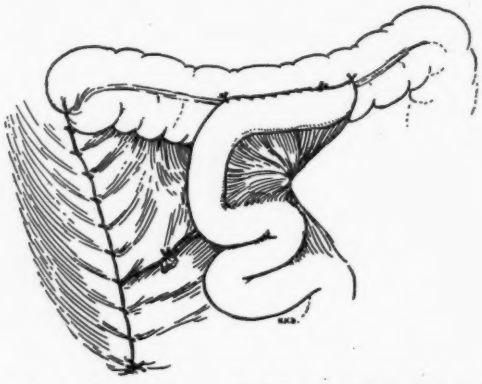

Fig. 4. After the removal of the ascending colon and closure of the transverse colon, the intra-abdominal operation is finished by closing the defect in the posterior peritoneum.

temporary intestinal obstruction results in a certain measure of toxæmia; for it has been fully established by experiments on dogs that, following the artificial induction of intestinal obstruction, definite chemical changes in the blood appear within a relatively short time. It would seem of advantage, therefore, to utilize a procedure that avoids even a temporary intestinal obstruction.

Once the intestinal anastomosis has been established, the operation may be discontinued at any time; whereas, when the cæcum is resected first, it is necessary to complete the anastomosis. Should the patient's condition become unfavorable during the resection of the cæcum in the reversed procedure that I am advocating, operation may be discontinued at once. If the cæcum has already been mobilized and the resection is well under way, it may be left outside the abdominal wound, to be removed at such time as the patient's condition permits.

TECHNIQUE

In performing anastomosis of the ileum to the transverse colon followed by resection of the cæcum, I have largely followed the technique described by Victor Schmieden (1) in *Chirurgische Operationslehre*, pages 356 to 363. My results have been so favorable as to impress me with the superiority of this procedure over the method customarily practiced.

The type of ileocæcal resection here described is applicable to the treatment of neoplasms, intussusception, and tuberculosis of the cæcum.

A long pararectal incision is made on the right side to expose the site of operation. It may be prolonged upward or downward, according to indications. A small incision is not desirable, as it may prolong the operation and increase the difficulties. When the tumor is exposed, the patient is placed in a moderate Trendelenburg position with the right side a little higher, to keep loops of small intestine away from operating field.

The intestinal anastomosis should be effected before beginning resection of the cæcum. Two firm ligatures are placed at a point about 6 to 8 inches (15 to 20 centimeters) above the ileocæcal valve and the intestine is sectioned between them with the thermocautery or phenolized scalpel. The two cut ends are then folded in and sutured or secured by a purse-string suture, and the pads changed. Step by step between two ligatures the mesentery of the small intestine is separated from the part of the intestine still united with the cæcum. The direction of this mesenteric separation depends on the degree of involvement of the mesenteric lymph glands.

The next step is the implantation of the proximal end of the ileum into the transverse colon. This is accomplished by a lateral isoperistaltic apposition through the tænia coli and a wide anastomosis. Many operators employ the Murphy button for this purpose. Being easily accessible through the incision, the middle of the transverse colon is used. The anastomosis is then replaced into the abdominal cavity, which is well filled with new pads.

The cæcum is resected as follows: It is drawn toward the median line and the outer fold of the peritoneum is cut away from its lateral and lower borders. No important blood vessels are en-

countered in this procedure. The cæcum is then brought further from its source toward the median line, so that its posterior extraperitoneal portion becomes visible. Then the right ureter is exposed as it turns downward over the psoas major muscle. In this way it may be protected from injury. The intestine now hangs on the median fold of its mesentery, which contains the large blood vessels passing to the ileocæcal region.

The next step is gradual separation between ligatures of the inner fold of the mesentery, while the cæcum is being lifted upward. How much of the mesentery must be taken with the cæcum depends on the degree of involvement of the lymph glands. Enlarged glands are most likely to be found at the points of origin of the ileocolic and right colic branches of the superior mesenteric artery. A large portion of the posterior abdominal wall must be denuded of peritoneum. When the ascending colon is detached upward, the lower portion of the duodenum is encountered. It must be carefully protected from injury. To one side of this retroperitoneal loop of duodenum lies the right kidney. The mesentery is detached and ligatured and the ascending colon drawn forward up to the healthy portion. The central ligatures must be very carefully placed, as any break would result in severe hæmorrhage. The first ligature in the mesentery is placed close to the intestine. The cæcum itself has no mesentery.

The closure of the end of the large intestine does not differ in principle from that of the small intestine; but it is more difficult, as such intestinal stumps are easily perforated. A preliminary closure is made with ligatures, according to Graser's method. Then two or more infolding sutures are made according to Lembert's method and the appendices epiploicæ are sutured over them, or the stumps may be protected with omentum. It is important to cover a portion of the intestine behind the stump with peritoneum, so that the suture may join surfaces covered with serous membrane. Then the stump is repeatedly infolded until the closed end is near the posterior abdominal wall. With this method of closure the intestine can usually be returned to the abdominal cavity, but a drain may be placed near it as a precaution. Usually no drain is required. It should be used only when the surgeon is not sure of his asepsis and there has been difficulty in closing the retroperitoneal space. Schmieden opposes suturing the stump in the abdominal incision, as this procedure is apt to interfere with the circulation or stretch the mesentery.

Although extensive, this operation may be performed with very little loss of blood, except in the case of widespread lesions. It has the advantage of avoiding the necessity of leaving an ileal fistula, should the patient's condition become alarming at any time, since the intestinal anastomosis is completed before the resection of the cæcum is begun.

If there are numerous adhesions, the difficulties of the operation are increased. In such cases, it may be advisable to perform a two-stage operation. If the second stage of the operation is to be performed a few days later, the abdominal wound may be left open for the most part and the portion to be resected shut off from the rest of the abdominal cavity by tamponade. After the involved portion of intestine is shut off so that cæcal matter does not pass through it, the wound may be closed so as to leave a fistula of only this portion. Then resection may be done several weeks later. In such cases, not only the cæcum but also the hepatic flexure should be excluded. In some cases, complete resection is impossible and the ileocæcal region can only be excluded from the rest of the intestine and radical operation not done.

CONCLUSIONS

1. Resection of the cæcum and part of the ascending colon is usually indicated for malignant disease in this locality, also for tuberculosis of the cæcum and chronic ileocolic intussusception. In malignant disease, it relieves intestinal obstruction, prolongs life, and greatly lessens the patient's discomfort.

2. Although the end-results of ileocæcal resection are good, there is a high operative mortality following the usual operation.

3. Infection from fæcal contamination, surgical shock, and toxæmia from temporary intestinal obstruction play a large part in causing the high mortality from ileocæcal resection.

4. By reversing the usual procedure and performing the ileocolic anastomosis before excising the cæcum, we may greatly reduce the mortality. Should the patient's condition become alarming during the course of the operation, the latter may be discontinued at once. Furthermore, the danger of infection and toxæmia from temporary intestinal obstruction is greatly diminished.

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EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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AUGUST, 1928

CO-OPERATION OF SURGEON AND PEDIATRICIAN

ONE factor in the recent progress of surgery has been the co-operation of the internist and surgeon in the pre-operative preparation and postoperative care of the patient. Co-operation of pediatrician and surgeon is even more essential because few surgeons are well versed in the care of children, particularly infants. To meet this situation a number of children's hospitals have been so organized that all children are admitted to the medical service and the surgeon acts as a consultant, as do the otolaryngologist, ophthalmologist, and other specialists. This mode of hospitalization aims to secure proper attention to the nutrition and general health of the child.

Every child who is to undergo a surgical operation necessitating general anæsthesia should have a general physical examination within the 24 hours preceding operation in order to rule out the presence of acute infection, especially of the upper respiratory tract, as well as any of the infectious diseases, and also to be sure that the nutritional condition is such that healing will proceed normally after operation. One of the most glaring mistakes is to admit patients to hospitals for tonsillectomy on the morning of the operation, sending them directly to the operating room without previous examination and without even having the temperature taken. It is, therefore, not surprising that postoperative complications and even sudden death occur so frequently.

Next to circumcision, the operation most frequently performed on very young patients is for hare-lip and cleft palate. This group of patients presents a definite nutritional problem for many are markedly undernourished because the deformity has prevented them from nursing at the breast or has made the taking of food difficult. For a surgeon to operate on a patient who is several pounds underweight is to invite not only operative failure but possibly the death of the patient. Feeding by gavage for a period sufficiently long to bring these children up to practically normal weight will insure freedom from marked febrile reactions, bring about prompt, complete healing, and reduce mortality to practically nil.

The co-operation of surgeon and pediatrician is particularly necessary in the care of patients with pyloric stenosis. Many patients recover by medical treatment alone, but a certain group requires surgical attention. Operation is sometimes delayed in these cases until the surgical risk is unnecessarily increased. A bad surgical risk may, in 24 hours, be transformed into a fairly good surgical risk by means of blood transfusion, proper intravenous injection of glucose and physiological sodium chloride solution by hypodermoclysis. The

postoperative care of these patients is as important as the pre-operative care and in this the pediatrician can render valuable aid.

Surgical tuberculosis in childhood probably offers the best opportunity for the co-operation of pediatrician and surgeon. The care of the tuberculous lesion itself is surgical and the development of the patient's general immunity by adequate antituberculous regimen as well as by careful removal of all foci of acute infection, and the care of infections as they arise, is the duty of the pediatrician.

The temporary feeding of children by intravenous administration of glucose has increased the rate of recovery from operations following which it has been impossible to supply nourishment either by stomach or bowel.

The close co-operation of surgeon and pediatrician has already accomplished much in reducing the dangers of surgery, but there is still much to be done.

H. F. HELMHOLZ.

EARLY DIAGNOSIS OF BRAIN TUMOR

THE surgery of the brain and nervous system is now a well established field and its results compare favorably with those of the other surgical specialties. The general attitude of the profession toward its outlook is definitely changed and is becoming more and more favorable. Encouraging though its progress has been, there are still many important problems to be solved. Prominent among these is early diagnosis of brain tumors.

Diagnosis should be made early in order to avoid the inevitable unfavorable results of brain tumor pressure, which are: primary or secondary destruction of the centers or pathways, lowering of vitality, and later the collapse of the medullary centers and death.

There are still far too many cases coming in with late diagnoses, either because incorrectly diagnosed in the early stages or else, though correctly diagnosed, surgical treatment has been too long delayed. Some reasons for this situation are: (1) the hurried or cursory examinations; (2) failure to use the ophthalmoscope and similar instruments of precision; (3) partial examinations by specialists who think in terms of their own field only and who have little knowledge of or interest in neurology; (4) the constant migration of patients and inadequate follow-up; (5) the ultraconservative attitude of some physicians who purposely delay a case until the late stages or influence against surgical treatment; and (6) the general lack of knowledge, particularly among the laity, of early signs and symptoms of brain tumors.

The diagnosis, localization, and treatment of brain tumors are difficult under the most favorable conditions and are doubtlessly best done only in properly equipped centers. To the teaching and research institutions will largely fall the working out of such problems as more refined methods of examination for localization and the proper interpretation of symptoms, etc. The neurosurgeons are probably best equipped to work out further problems in surgical technique, and with the radiologists to direct the postoperative care. Perhaps some day the exact causes and nature of brain tumors will be known and a specific cure developed, but until that time comes, we can only hope for better results by improving present methods or developing new ones.

A very important factor in the problem is the attitude and work of the general practitioner who sees the mass of people day by day. It is here that definite improvement can be hoped for, and to this end we would stress a more thorough grounding in neurology and a

more widespread use of the ophthalmoscope. The practitioner should be constantly on the lookout for brain tumor cases, seeing to it that the suspicious ones are adequately examined by specialists, and urging a periodic follow-up of all the suspects. In this way, more cases would be detected and properly guided to early treatment. The general public can also definitely assist, if they are more generally instructed in a suitable way, as to the early signs and symptoms of brain tumors, the serious consequences of waiting, and the more favorable results of the modern surgical treatment—just as they are being taught about goiter and cancer, and just as they have learned about tuberculosis.

A greatly heightened degree of suspicion toward the presence of brain tumors must be developed similar to that toward syphilis, breast tumors, gastric ulcers, etc. The condition has always been considered more or less rare and hence has doubtless been often overlooked. If the profession and the public were more on the lookout for the condition, more cases would be examined in the early stages, and the suspicious ones, not definitely diagnosed, would be kept track of more adequately.

The attitude of the profession toward the outlook of these cases has become, in general, more definitely optimistic, but there are still many who retain the old pessimism, and deliberately advise against adequate surgical treatment. Some day we may be able to predict before operation the probable outcome of each case, but at present this can rarely be done and by postponing or rejecting surgical treatment, some patients needlessly die early or become blind for life.

The importance of early diagnosis, of course, applies equally well to the other surgical conditions, but we would stress it particularly for brain tumors for only in this way can we hope for very definite progress in the successful treatment of this most difficult but important condition. ALBERT S. CRAWFORD.

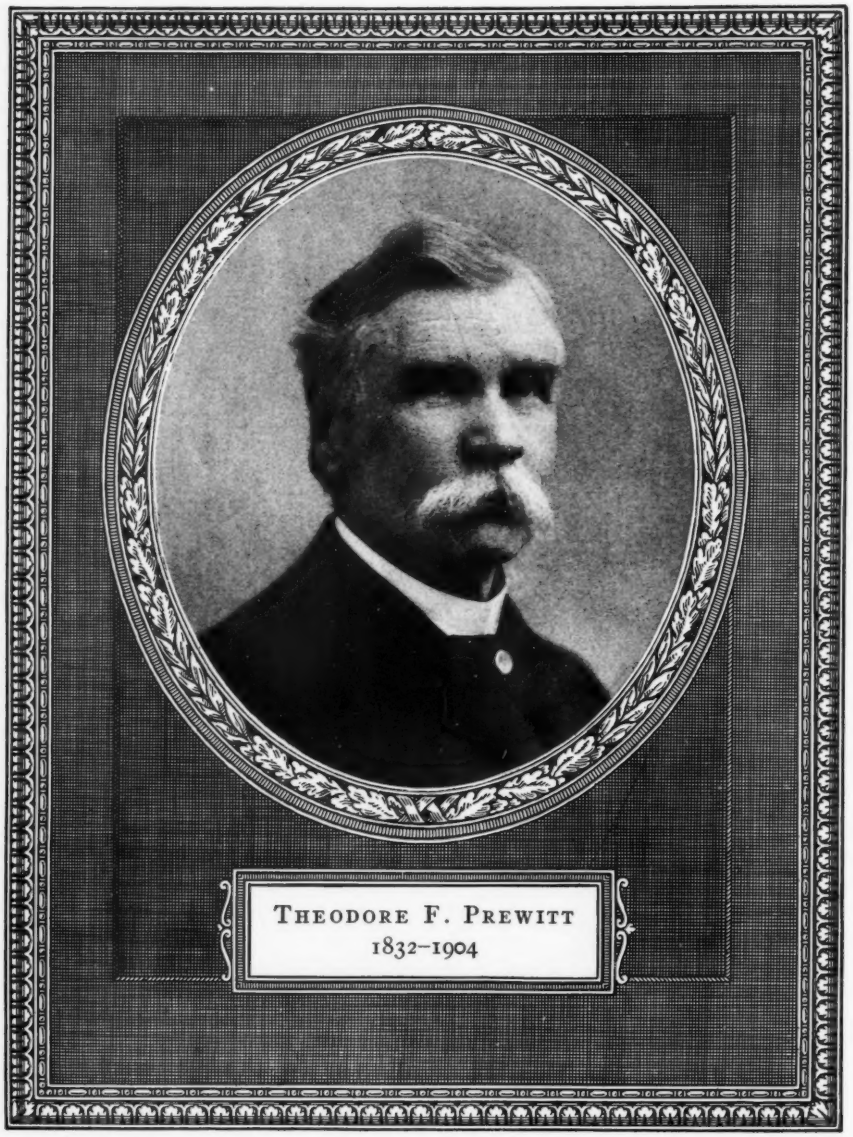
MASTER SURGEONS OF AMERICA

THEODORE FRELINGHUYSEN PREWITT

THERE are many men whose teachings, beneficent influence, and good example are carried along indefinitely through succeeding generations without proper credit being given to him who deserves it. So it might be with the name of Theodore F. Prewitt. His writings would make a considerable number of large volumes if they were compiled in such form. He wrote no textbooks but his teachings will undoubtedly bear fruit for many years, because his pupils and assistants are widely distributed throughout this midwestern territory. They are practicing and teaching and so are disseminating that knowledge which they have learned from their chief and master.

Theodore Prewitt was the son of Joel and Mary Trimble Prewitt. He was born in rural Missouri at Fayette in Howard County on March 1, 1832. By the death of his father, who left a family of eleven children, this schoolboy was thrown upon his own resources at the early age of 14. It is said that he was employed for a time as a blacksmith's helper. This may explain the reason for the tremendous development of the muscles of his arms and shoulders which gave him the ability to exert that great amount of force which, in addition to his acquired skill, attracted attention whenever he reduced fractures and dislocations, some of which had defied the attempts of others to reduce them. By perseverance and industrious application he acquired as good an education as was possible to obtain at a Missouri country side, and this enabled him to teach school for a number of years. He entered St. Louis Medical College and graduated in 1856. He married Miss Mary Ingram of Virginia during the senior year of his medical course and at once began the practice of medicine at Utica, Missouri.

Upon the death of his wife in 1862, he came to St. Louis, entered into practice, and soon became identified with medical education, teaching dermatology at the original St. Louis College of Physicians and Surgeons. Later he became demonstrator in anatomy and assistant to the chair of surgery at the Missouri Medical College. In 1871 he was married to Miss Mary Sowers, who still survives, and in that year he was appointed superintendent of the St. Louis City Hospital. Three years later he resigned this position to continue his surgical



THEODORE F. PREWITT
1832–1904

UNIV OF MICH.

studies at the European medical centers. Upon his return from abroad, he accepted the chair of principles and practice of surgery at the Missouri Medical College and later was for several years dean of this institution. After the consolidation with the St. Louis Medical College in 1899 to form the Medical School of Washington University he continued in this same professorship. Only when his advancing age and failing health prevented it during the last 2 years of his life, did he fail to lecture regularly. This disability was due to arteriosclerosis and several light strokes of apoplexy. He recovered fairly well from the resulting hemiplegia but finally succumbed to a severe cerebral hæmorrhage on October 17, 1904.

For a quarter of a century he was chief surgeon to St. John's Hospital and director of St. John's Surgical Clinic. It was here that his most important work was accomplished and that material gathered which he presented at his frequent appearances before medical and surgical societies, the meetings of which he attended with great regularity.

Besides other offices held by him at various times, he was president of the following organizations: St. Louis Medical Society (1876), Missouri State Medical Association (1897), St. Louis Surgical Society, American Surgical Association (1900), and the St. Louis Obstetrical Society. He was also a Fellow of the American Medical Association and of the Philadelphia Academy of Surgery.

"Be not the first by whom the new is tried,
Nor yet the last to cast the old aside."

This rule he frequently quoted and always kept in mind. Thus he made himself exceptionally useful in the application of accepted methods. But this motto did not lessen his eagerness to learn the latest innovations and he never hesitated to apply any procedure which seemed practical in the light of scientific reasoning. Living and working as he did, in a period of great progress in medicine and surgery, he saw these developments at close range and utilized the new discoveries as promptly as their worth was recognized.

When in the year 1893, the daily press announced the discovery of the X-rays by Professor Roentgen, Dr. Prewitt immediately appreciated their great value in the field of surgery. With the intention of using these rays in his practice he forthwith consulted Prof. Charles O. Curtman and several others who were familiar with induction coils and Crookes' tubes. The apparatus of that day was too small and weak to give practical results. So he could not apply this new discovery as soon as he wanted it. The matter was dropped for a short time, only to be taken up again when a more powerful coil and larger tubes had been invented and manufactured. During this period Dr. Prewitt manifested an extraordinary spirit of impatience and anxiety which he never entirely lost. He left this world before the X-rays could be properly controlled and their application established as a distinct branch of medical practice.

I am able to give only a vague idea of his clear and logical reasoning which was usually followed by definite and positive conclusions; nor can the proper comprehension of the remarkable diagnostic genius of this man be drawn from any account that I might picture to those who did not at some time or other have the privilege of daily contact with him. In those pre-X-ray days he astounded those associated with him when he recognized by exclusion of other possibilities, a small osteosarcoma which grew from the glenoid process of the scapula and when he proved his contention by a subsequent surgical procedure.

At another time he made a diagnosis of ectopic pregnancy twice in the same fallopian tube. This was long before blood cell counts were a daily routine. At its first occurrence he strongly urged operation. The woman persistently refused but recovered after a fairly long period of illness. A few years later he found the same condition in the same fallopian tube. This time he was again certain, obtained her consent by pleading with the patient, and verified his diagnosis at operation. The specimen showed the recent rent with the usual extravasation of blood and also the cicatrized site of the earlier rupture in that same tube. May these two illustrations suffice to show the extraordinary diagnostic ability which came only from many years of study and observation coupled with an innate fitness for this work! Such a combination is seldom found.

His resourcefulness was another outstanding and characteristic trait. I will narrate but one occurrence to illustrate this. A woman had suffered great loss of blood at an uncompleted abdominal operation attempted by another surgeon. She was nearly exsanguinated. Blood transfusion was not done in those days. Not even the apparatus for infusion of salt solution was at hand. With a Davidson bulb syringe (the forerunner and predecessor of the fountain syringe), Dr. Prewitt pumped enough sterile normal saline solution into the woman's veins so that she recovered. A small nozzle had been scraped to make it still smaller so that it could be introduced into the opened vein. This patient was later successfully operated on for the then existing uterine fibroid.

Probably the only semblance of a hobby was his fondness for the works of William Shakespeare. He must have devoted considerable time to this study because he quoted from them whenever occasion offered the opportunity. It has been said that he was able to continue almost any quotation begun by others.

Professor Prewitt's most brilliant work was done in the clinical amphitheatre, which institution is now fast becoming extinct. There he repeated to the students those methods of diagnosis of which he was master, and which endeared him so with the large classes of medical students of that day. While other surgeons of his time were satisfied with a simple amputation of the breast for carcinoma, he dissected out the axillary and subclavian glands. Thus he anticipated the radical operation as it was developed afterward. His percentage of

permanent cures was correspondingly greater than that of his less radical contemporaries.

Brilliantly daring were his dissections of the neck for tuberculous glands or malignant disease, and plastic surgery had a particular attraction for him. In all of his operations he showed a disregard for speed and spectacular show. His aim was toward thoroughness and ultimate results.

The published writings of this great teacher are many and varied. They cover a large part of the field of general surgery and sometimes they invade the other branches of medicine. But they give only fair idea of his great courage and determination which were always evident to those who had the advantage of being associated with him in his work.

It can be readily imagined that such a man would soon feel the need of a medical library, and therefore he started the movement to organize a medical library in connection with the St. Louis Medical Society and headed a committee appointed for that purpose as early as July 1, 1865. They reported on September 30 of that year and the adoption of this report established the first public medical library west of the Mississippi River. It was housed for a long period of time in the Public Library but later formed the nucleus of that great collection which now is again known as the Library of the St. Louis Medical Society. If any St. Louisan has contributed more to the advancement of medicine and surgery in the city of St. Louis than did Professor Prewitt, the records fail to reveal it. For over 40 years he continually served the profession and the public with all his energy. Not even when his carriage, drawn by the team of roan horses, took him on his rounds did he rest his ever active mind. There were always several books and periodicals on the seat beside him in this vehicle. He read the newer literature but did not neglect the textbooks with which he constantly refreshed his memory. Never was he unprepared when he entered the lecture room.

The surgery of today is not the surgery of the past generation. Laboratory methods and newer developments of many kinds have brought about an unprecedented progress. However, it is to be regretted that there is throughout it all an evident neglect of that patient bedside study and wide range of medical knowledge which broadened the viewpoint, and produced those masters whose memory is so dear to us. Any list of these pioneers will be incomplete without the name of T. F. Prewitt.

ROBERT E. SCHLUETER

CORRESPONDENCE

THE DELIVERY OF THE ADHERENT PLACENTA BY THE MOJON-GABASTON METHOD

To the Editor.—As a surgeon, I have no experience of cases of adherent placenta, but the technique, described by Dr. Julius Jarcho in SURGERY, GYNECOLOGY AND OBSTETRICS of February, 1928, of injecting saline solution into the vein of the umbilical cord, by means of a record syringe, appears, to me, capable of improvement. In the *Practitioner* of October, 1918, I described a method of intravenous injection of fluids, which I have used repeatedly for 30 years.

Briefly, this method consists in the use of a blunt, bulbous-ended cannula, attached by a length of rubber tubing to an ordinary Higginson enema syringe, the cannula being tied into the vein. The method is simple, gives the operator absolute control of the amount and rate of injection, and appears to be admirably suited to cases such as those described by Dr. Jarcho.

C. HAMILTON WHITEFORD, M.R.C.S., L.R.C.P.
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LIGATURE OF THE ANGULAR VEIN AS A PREVENTIVE MEASURE IN FACIAL CARBUNCLE

To the Editor.—Hamilton Bailey, in his article "Ligature of the Angular Vein as a Preventive Measure in Facial Carbuncle," in the April, 1928, number of SURGERY, GYNECOLOGY AND OBSTETRICS states:

"To forestall the spread of infection by this route (angular vein), ligation of the angular vein *must* be a sound proposition. . . .

"Ligature of the angular vein under local anæsthesia is a measure which is *entirely free from danger, and one which can only do good.* . . .

"If, in addition to this sign (suffusion of the eyelids) there is considerable elevation of temperature, the *call for action is imperative.*"

It cannot be conceded that ligation of the angular vein *must* be safe and that it is not fraught with danger if done under local anæsthesia. There must be much trauma in working around the angular vein under local anæsthesia, especially if there is a great deal of peri-orbital œdema. We have all learned from sad experience that trauma of any kind helps the spread of infection through superficial lymphatics, especially around the face. It has become almost axiomatic not to use a local anæsthetic in spreading infections on the face, for this offers a singular opportunity for further advance. It is exceedingly difficult to say when the angular vein has become invaded. Clinically, we see patients with the picture presented by Dr. Bailey, suffusion of the eyelids and high temperature, who have negative blood cultures repeatedly and who, under conservative therapy, get well without complications. In a recent communication[1] in which X-Ray therapy, surgery, conservative treatment, and circuminjection of autogenous blood in carbuncles[2] were evaluated, I think that it was shown pretty conclusively how difficult it is to draw conclusions from any one type of therapy in carbuncles, in which accessory therapeutic methods were also employed. These immediately introduced variable factors on one side of the equation. It was further shown how, for instance, one of these variable factors (conservative therapy) produced cure alone. Dr. Bailey reports only three cases. In Case 1 death occurred despite the ligature of the angular vein. In Case 2, there is no proof of a blood infection or involvement of the angular vein. Yet, ligature of the angular vein is given the credit for the cure, when accessory therapeutic measures (intravenous mercurochrome, hot magnesium sulphate fomentations) were also used. In Case 3 the patient, who had a positive staphylococcus blood culture, had a ligation of the angular vein and the injection of whole blood around the periphery of the carbuncle with local applications of hot fomentations and intravenous administration of mercurochrome. The patient recovered. How, then, can the result be attributed to ligation of the angular vein, when there was so much additional therapy, which in itself repeatedly produces cure?

This communication is not meant to decry the use of ligation of the angular vein in selected cases of carbuncle of the face, but rather to warn against the use of local anæsthesia for the procedure and to be guarded in drawing conclusions as to its real value. Rectal is far preferable to local anæsthesia. Much could be done to prevent fatalities in carbuncle of the face if the public could be educated not to prick or squeeze them, and if the profession could be further impressed, as it has been repeatedly before, not to traumatize them with instruments.

LOUIS CARP, M.D., F.A.C.S.
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ABDOMINAL FREMITUS IN PERFORATION

To the Editor.—Recently I noted in a patient with a perforated duodenal ulcer a symptom which I

[1] Carp, Louis. Treatment of carbuncles; a comparison of four different methods. Ann. Surg., 1927, lxxxvi, 702.
[2] Idem. Circuminjection of autogenous blood in the treatment of carbuncles. Arch. Surg., 1927, xiv, 868.

had never seen before and have never read of. This patient had been sent into the hospital from about 15 miles in the country. He was a man 37 years old, whose past history was negative except for some indefinite indigestion several years before. About 6 hours before I saw him he had suddenly developed terrific pain in the abdomen just to the right of the umbilicus, and had sent for his family physician, who had been obliged to give him three hypodermic injections of one quarter grain of morphine each. The pain had not been associated with vomiting or urinary disturbance.

When seen by me he was quite comfortable. His temperature was 98 degrees, pulse 80, and respiration 24. Leucocyte count was 16,300 with 90 per cent polymorphonuclear neutrophiles. Urinalysis was negative except for a faint trace of albumin and an occasional hyaline and granular cast. His abdomen was somewhat tender and slightly resistant all over. There was no localized tenderness or rigidity at any point. However, when the hand was placed on the right upper quadrant, a coarse fremitus could be felt,—similar to the vocal fremitus felt over the thorax,—but coarser and stronger. This was independent of breathing, talking, or moving. It gradually became weaker and finally disappeared as the palpating hand was moved away from the right upper quadrant.

I believed that this fremitus could only be due to fluid or gas escaping from a hollow viscus, and made a diagnosis of perforated peptic ulcer and urged immediate operation, although the patient did not appear very sick and other than the fremitus there was very little to substantiate the diagnosis. The large amount of morphine which the patient had received was undoubtedly masking his symptoms.

At operation a large duodenal ulcer with a very small perforation was found. As gas and fluid spurted through the perforation the surrounding tissues were made to vibrate, and this was responsible for the fremitus which had been present before operation.

While abdominal fremitus in cases of perforation of hollow viscera must be rare, if looked for it would probably prove to be present more frequently than might be expected. When present, it would be pathognomonic of perforation, and would prove most valuable in cases similar to mine, whose other symptoms have been obscured by large doses of morphine.

JOHN H. LYONS, M.D.
WASHINGTON, D. C.

AN UNUSUAL FATAL OPERATIVE WOUND INFECTION YIELDING A PATHOGENIC ANAEROBE OF THE GAS GANGRENE GROUP, WITH DIRECT REFERENCE TO CATGUT AS A SOURCE

To the Editor.—Since the publication of our paper in the December, 1927, number of SURGERY, GYNECOLOGY AND OBSTETRICS describing what we thought to be a new pathogenic anaerobe, we have found that Dr. A. Sordelli in Buenos Aires previously described an organism in 1922 similar to ours. Hall in the November, 1927, number of *Journal of Infectious Diseases* suggested that these organisms might be similar. We obtained Sordelli's strains from Hall and have determined by reciprocal serological tests that they are the same.[1] We yield, therefore, to Dr. Sordelli the priority of discovery and acknowledge bacillus Sordellii and C. œdematoides to be one and the same species.

FRANK L. MELENEY, M.D.
FREDRICK B. HUMPHREYS, M.D.
LOUIS CARP, M,D.
NEW YORK.

[1]The identity of clostridium œdematoides and bacillus Sordellii. Frederick Humphreys and Frank L. Meleney. Proc. Soc. Exper. Biol. & Med., 1928, XXV, 611-614.

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

By ALFRED BROWN, M.D., F.A.C.S., Omaha

THE MEDICO-SURGICAL OBSERVATIONS OF JOBI A MEEK'REN

THE sixteenth century had produced the standardization of anatomy as a science and thus furnished a basis upon which the practice of surgery was to be founded. Consequently anatomy had withdrawn a little from surgery so far as publication by the clinician was concerned, and he left that part of his science to those better fitted to carry it on; especially as Paré and his contemporaries had raised the surgeon to a position of prominence in the profession both as a consultant and operator. Translations and amendments of the books of the ancients had been made and remade until that field of literary endeavor was pretty well played out through over cultivation and in literary as in agricultural pursuits diversification of crops is essential if success is to be attained.

At the beginning of the seventeenth century surgeons were looking for other methods to express themselves. Harvey, in the early part of the century was to bring forward his idea of the circulation, but this was far too advanced in thought and upheaving in character to appeal to the rank and file of the profession and it was to be in a later century that John Hunter was to evolve his views of the fundamental pathology of inflammatory conditions which were to give the surgeons something new to think about.

Faced with this condition of affairs, the answer was apparently found in the fact that it became the fashion to publish books consisting in the retailing of long lists of clinical cases—many of them without any relation to one another—and without any definite deductions drawn from them. They appear to be in great measure written from an ethical advertising standpoint retailing the wonders of the case—the more outlandish it seems and marvelous the better—and calling particular attention to the great skill and ability of the author in the handling of the condition, especially if several others had failed before he was called.

The work of Jobi a Meek'ren or Jac. van Meek'ren, a Dutch "Heelmeester" or surgeon and anatomist of Amsterdam, Holland, who died in 1666 is a typical example of the "Observations" or "Consilia" of the seventeenth century. The work apparently appeared first written in Flemish for the title page reads: "The Medico-Surgical Observations of Jobi a Meek'ren Surgeon of Amsterdam, translated from the Belgian into Latin by Abraham Blasius, son of Gerard, student of Medicine, Amsterdam, from the workshop of Henricus and the widow of Theodorus Boom, 1682." Abraham Blasius dedicates his translation to his father Gerard who was an anatomist, and annotated the work of Vesling. For a time he posed as the discoverer of the parotid duct until Stenon in a letter to Bartholin disproved his claim.

Meek'ren in his preface states his belief that advance in surgery will best be gained by adding fact to fact, until as he expresses it: "If each one of us adds one grain of sand to the complement of the illustrious and noble Art of Medicine, soon immense treasures and innumerable gifts will be brought together to fill the needs of ourselves, our fellow citizens, and our posterity to cure disease surely."

Meek'ren proceeds to his task after the usual manner of the time, beginning with fractures of the skull and ending the main treatise with surgical diseases of the lower extremity. The translator had added some posthumous observations divided into chapters, the first of which deals with monsters among which one notes both possible anomalies and some which must be placed in the realm of the visionary. The title page gives a fair idea of the type of case which is illustrated and described in the body of the work. The rubber skinned man was a young Spaniard aged 23 that Meek'ren saw in consultation with several physicians in Amsterdam. He offers no explanation of the abnormality. The third patient from the right standing at the table was a young lady who had what Meek'ren describes as a cartilaginous nasal polyp which he removed through the mouth and the nasopharynx with resulting cure. One must consider the picture a bit exaggerated.

Meek'ren illustrates ganglion of the wrist and the method of breaking it with a blow of the fist. He reduces fracture of the coccyx manually and performs many of the manipulations in common use today. When possible he obtained postmortem examinations and gives the findings, but unfortunately they are so brief in many instances that it is difficult to make an accurate diagnosis. Constantly throughout the work he quotes authorities, going back to Hippocrates in some instances and in others referring to his contemporaries. One closes the book with the feeling that Meek'ren has added far more than his "one grain of sand to the complement of the illustrious and noble Art of Medicine."

JOBI a MEEKREN

OBSERVATIONES

Medico Chirurgicæ.

AMSTELODAMI,
Ex officina Henrici et Viduæ Theodori Boom 1682.

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REVIEWS OF NEW BOOKS

THE idea of Crowe[1] to combine under the same cover the subjects of bacteriology and surgery of chronic arthritis is unique and commendable. In view of the stress of tremendous specialization of the present day when bacteriologists read and delve further into bacteriology only and surgeons restrict their studies to problems essentially surgical, this excellent work will make the surgeon read bacteriology and the bacteriologist acquaint himself with problems of a surgical kind. Closer union through more common interest and prolonging of co-operation over a period of time between surgeon and bacteriologist, undeniably promotes intelligent treatment surgically of the chronic arthritis.

The book gives a composite classification of arthritis with a comprehensive discussion and profuse reference to the literature. The chapter on arthritis sets forth the present day views of many writers on the subject, together with the classification of arthritis. In addition, it gives the author's opinion that both staphylococcus and streptococcus are the etiologic factors in the production of arthritis.

It seems to me to be unfortunate that the section written by Dr. Price on dental infection has been allotted so much space, as it tends to convey the impression that his opinion is far more important than is generally credited by his confrères in oral surgery.

It is the reviewer's impression that in the chapter on surgery, the discussion of surgical technique will be of little value to the surgeon. The bacteriological discussion should, however, be of great value in affecting surgical judgment as to operative indications.

Essentially this book is an endeavor to clear up the hazy ideas of the streptococcus and to give us a new classification. While the author's method will not be the last word, it will serve as a stepping stone for other bacteriologists to carry on, blazing new trails in our present jungle of facts and ideas on this subject. The work of compiling this book represents the laborious assembling of hitherto scattered information. The comprehensiveness and the simplicity of style of this book make it very readable. The author should be commended for his sincere purpose of searching for truth.

One of the most worthwhile results of a work such as this is to focus attention on the necessity for closer contact between the surgeon and the bacteriologist, with the purpose of having the bacteriologist render an opinion which is much more personal and cognizant of the case in hand than is the present impersonal academic decision not referable to any particular individual.

The book is of little value from the point of view of surgical technique, but does serve to revise and bring up to date a surgical concept of the rôle of streptococcus in arthritis and bone and joint surgery.

LAURENCE H. MAYERS.

THIS atlas by Bertwistle and Shenton[2] is an excellent graphic exposition of the subject of typical X-ray examples of normal and abnormal lesions. The atlas method commends itself in X-ray works that are intended as reference books as well as material for teaching roentgenological interpretation.

The authors have presented a very wide range of the practical application of the X-ray in diagnostic studies. The illustrations are of a high order; each one is accompanied by a systematic analysis which adds greatly to the value of cases presented.

This combination of the clinical with the X-ray features is illustrative of what should be more generally practiced by the referring physician and the roentgenologist. The closer co-operation of clinician and laboratorian will result in a better understanding of the more minute details of the patient's condition and will give the best possible results. The book is divided into anatomical systems each of which is adequately covered by splendid illustrations and explanatory text. The authors show among other applications of the X-ray in diagnosis the use of lipiodol in lesions of the nervous system but do not include the important injection of this material in the respiratory tract, which is now being used with increasing frequency by American roentgenologists and thoracic surgeons. EDWARD S. BLAINE.

THIS eighth edition[3] of the synopsis of surgery has little over two pages more than the seventh. These are utilized in an excellent discussion of poliomyelitis. Further changes are:—a revision of the chapter on hydrocephalus which is improved by a classification according to etiology; and mention of the Graham Cole method of cholecystography. Save the changes here mentioned the text is identical with the previous edition.

SAM FOGELSON.

THE eighth edition[4] of *Diagnostic Chirurgical* is represented by a large volume of 1231 pages. It has undergone considerable change since its first appearance in 1895. The work is characterized by considerable didactic skill; the diagnosis of various surgical conditions is treated in the completest

[1] BACTERIOLOGY AND SURGERY OF CHRONIC ARTHRITIS AND RHEUMATISM; WITH END-RESULTS OF TREATMENT. By H. Warren Crowe, D.M., B.Ch. (Ox.), M.R.C.S., L.R.C.P. The Chapter on Surgical Treatment by Herbert Frankling, C.B.E., M.R.C.S. (Eng.).

[2] A DESCRIPTIVE ATLAS OF VISCERAL RADIOGRAMS. By A. P. Bertwistle, M.B., Ch.B., F.R.C.S. (Edin.), and E. W. H. Shenton, M.R.C.S., L.R.C.P. St. Louis: The C. V. Mosby Company, 1926.

[3] A SYNOPSIS OF SURGERY. By Ernest W. Hey Groves, M.S., M.D., B.Sc. (Lond.), F.R.C.S. (Eng.). 8th ed. New York: William Wood and Company, 1927.

[4] DIAGNOSTIC CHIRURGICAL (Duplay, Rochard, Demoulin, Stern). 8th ed., entirely rev. by W. M. Stern. Paris: Gaston Doin et Cie, 1928.

possible fashion. Characteristic of French works on surgical diagnosis, the field of gynecology is likewise included. The book is illustrated by numerous well selected and instructive pictures. The radiograms, however, are of a very inferior quality.

GEORGE HALPERIN.

IN a valuable and interesting monograph,[1] Pauchet analyzes his experience with the surgical treatment of gastric cancer. The text is illustrated by excellent pictures of the successive stages of the operation of gastric resection. In fact, they appear to be the more valuable part of the monograph. So far as the technique of the operation is concerned a special emphasis is laid upon the resection of the great omentum along with the stomach so as to remove possible lymph metastases. Pauchet prefers an anterior gastro-enterostomy with the addition of Braun-Jaboulay's entero-enterostomy. He is an enthusiastic advocate of the exploratory laparotomy. His indications for resection are broad. In his operative material, the mortality amounted to 27 per cent, whereas in the number of cures based upon a 5-year limit it was 31.3 per cent, a very remarkable result. The monograph is completed by an instructive histopathological study by Hirchberg.

GEORGE HALPERIN.

IN order to celebrate fittingly the 25 years of brilliant teaching in the Policlinico of Rome, colleagues of Professor Raffaele Bastianelli dedicated volume eighteen[2] of the *Italian Archives of Surgery* to their teacher and friend.

American surgeons—Mayo, Albee, Judd, and Bloodgood—sent contributions; England and France contributed important articles. Of the many excellent Italian authors, one can only select a few for special mention: O. Manganucci has an excellent paper on retroperitoneal echinococcus cysts and their treatment; Putti writes on the early cure of congenital luxations of the hip; U. Archangeli reviews the subject of osteomalacia; Artom di Sant' Agnese advocates the transvesical and transvesicoperitoneal route for the repair of obstinate vesicovaginal fistulæ, reporting 9 cases of which 6 were successful. R. Falcon contributes a new method for the cure of hypospadias using the scrotum for the formation of a double pedicled new canal. He first sutures the new canal with the skin outside, waits 4 to 5 weeks for the circulation to be reestablished and stimulates proximal circulation in the new canal by applying intermittent elastic constriction on its distal end. The final step in his operation consists in severing the distal end of the canal, splitting it longitudinally with scissors and resuturing it with the skin inside. The formation of the penile canal and anchoring of the new tube are carried out according to classical lines. Falcone reports 2 successful cases.

[1] CANCER D'ESTOMAC. By Victor Pauchet and A. Hirchberg. Paris: Gaston Doin et Cie, 1928.

[2] ARCHIVIO ITALIANO DI CHIRURGIA. Diretorre: Mario Donati. vol. xviii. Bologna: L. Cappelli, 1927.

G. Egidi reports 10 cases of umbilical hernia permanently cured through the use of pedunculated strips of rectus fascia which he criss-crosses over the umbilical opening through two stab wounds in the rectus fascia. In this work he was inspired by L. L. McArthur's work on autoplastic sutures, published in 1904.

GEORGE DE TARNOWSKY.

EMERSON'S recently published textbook on physical diagnosis[3] is, in contrast to many of the more recent works on physical diagnosis, a leisurely, painstaking, and detailed discussion. It represents the point of view that, in spite of the enormous advances in scientific medicine in the laboratory and at the bed-side, physical diagnosis by the eye and hand still remains the basis of correct medicine. Fully one-third of the work may be said to be devoted to the results of inspection,—that is, general physical characteristics, skin diseases, and signs of phenomena to be seen in different parts of the body. This is as it should be, since inspection is the most neglected and perhaps the most valuable form of physical examination. One might question the use of 75 pages devoted to the description of skin lesions as being out of place in such a work.

A broad foundation for the student is laid by the introduction of many subjects not strictly a part of manual diagnosis, such as a history of physical diagnosis and a discussion of types of growth, obesity, posture, fever, and blood pressure. The character of the entire work is thorough and detailed. The printed page is sprinkled with phrases and headings in bold type. The classical signs of various lung findings are presented with many diagrams. The section on heart, as well as the rest of the work, is well illustrated. The discussion is complete; for instance, the technique for taking, and observations on the characteristics of, the pulse are discussed for 6 closely filled pages. This does not include a discussion of pulse arrhythmias. Frequent interesting and sound though not conventional opinions are expressed, for instance: "It is not true that thickening of the vessel walls is an almost physiological process . . . . a truly normal man of ninety should have as soft arteries as one of thirty years of age . . . . the presence of respiratory variation of the pulse would indicate a sound rather than an injured heart . . . a demonstrable enlargement of the heart is always due to cardiac dilatation; an extreme hypertrophy alone could increase the cardiac shadow scarcely one centimeter."

There is some question as to how this book should be used. Certainly, according to my experience as a student and judging by the knowledge of internes and students of the present, physical diagnosis is not receiving the attention which it should. If this book is to be used by students, far more time should be spent in didactic teaching of physical diagnosis and with such a work it could well be made one of the major subjects of the clinical years of medical

[3] PHYSICAL DIAGNOSIS. By Charles Phillips Emerson, A.B., M.D. Philadelphia and London: J. B. Lippincott Co., 1928.

school. It does not seem that the work is quite extensive enough to be used as a final reference work although apparently every phenomenon is at least mentioned. It is a book which should certainly be considered by any one interested in teaching or studying physical diagnosis. PAUL STARR.

KER'S valuable manual[1] on acute contagious diseases has appeared in its third edition since 1911. It is composed of a rather discursive introduction and a chapter of advice on the observation of rashes and throats, and then successive brief, clear descriptions of measles, rubella, scarlet fever, smallpox, vaccinia, chicken-pox, typhus fever, enteric fever, diphtheria, erysipelas, whooping cough, mumps, and cerebrospinal meningitis. A photograph of the rash or distinctive lesion in each of these conditions is reproduced.

This manual has been brought up to date by Dr. Rundle and includes a description of the more recent immunological advances in the treatment of these fevers. He is possibly not as enthusiastic concerning active immunity as prophylaxis in diphtheria as our American writers but, nevertheless, admits its success. He is still more conservative in regard to the specific antiserum in the treatment of scarlet fever, which to us seems to be eminently successful. Likewise in the treatment of erysipelas he rather discourages the use of an antiserum although recent American experience indicates that very successful results may be obtained with a new antiserum.

Except for such differences of opinion the book is a very valuable description of these common diseases and should continue to be of use to students and practitioners. PAUL STARR.

[1] KER'S MANUAL OF FEVERS. Revised by Claude Rundle, O.B.E. M.D. (Lond.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), D.P.H. 3d ed. New York: Oxford University Press, 1927.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

DIE TECHNIK DES ORTHOPAEDISCHEN EINGRIFFS; EINE OPERATIONSLEHRE AUS DEM GESAMTGEBIET DER ORTHOPAEDIE. By Dr. Philipp J. Erlacher. Vienna: Julius Springer, 1928.

THE MATERIAL AND METHODS OF THE GYNÆCOLOGICAL AND OBSTETRICAL DEPARTMENT IN THE UNIVERSITY OF LIVERPOOL. By W. Blair Bell, B.S., M.D. (Lond.) Hon. F.A.C.S. Manchester: Sherratt & Hughes, 1928.

BIOLOGIE UND PATHOLOGIE DES WEIBES; EIN HANDBUCH DER FRAUENHEILKUNDE UND GEBURTSHILFE. By Josef Halban and Ludwig Seitz. Lieferung 43. Berlin and Vienna: Urban & Schwarzenberg, 1928.

LES TUMEURS VILLEUSES DE RECTUM. By André Lambling. Paris: Masson & Cie, 1928.

DIATHERMY; ITS PRODUCTION AND USES IN MEDICINE AND SURGERY. By Elkin P. Cumberbatch, M.A., B.M. (Oxon.), D.M.R.E.(Camb.), M.R.C.P. 2d ed. St. Louis: The C.V. Mosby Co., 1928.

A HANDBOOK OF CLINICAL GYNECOLOGY AND OBSTETRICS. By Rae Thornton La Vake, A.B., M.D., F.A.C.S. St. Louis: The C. V. Mosby Company, 1928.

THE DUODENUM; MEDICAL, RADIOLOGIC AND SURGICAL STUDIES. By Pierre Duval, Jean Charles Roux and Henri Béclère. Translated by E. P. Quain, M.D. St. Louis: The C. V. Mosby Company, 1928.

OPERATIVE SURGERY. By J. Shelton Horsley, M.D., F.A.C.S. 3d ed. St. Louis: The C. V. Mosby Company, 1928.

COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION. Edited by Mrs. M. H. Mellish and H. Burton Logie, M.D. Vol. xix, 1927. Published May, 1928. Philadelphia and London: W. B. Saunders Company, 1928.

SURGICAL PAPERS. By William Stewart Halsted. Vols. i and ii. Baltimore: The Johns Hopkins Press, 1924.

CLINICAL MEDICINE. By Oscar W. Bethea, M.D., Ph.G., F.C.S., F.A.C.P. Philadelphia and London: W. B. Saunders Company, 1928.

A MANUAL OF SURGICAL ANATOMY. By Charles R. Whittaker, F.R.C.S.(Edin.), F.R.S.E. 4th ed. rev. and enlarged. New York: William Wood & Company, 1928.

ANNUAL REPRINT OF THE REPORTS OF THE COUNCIL ON PHARMACY AND CHEMISTRY OF THE AMERICAN MEDICAL ASSOCIATION FOR 1927 WITH THE COMMENTS THAT HAVE APPEARED IN THE JOURNAL. Chicago: American Medical Association, 1928.

NEW AND NONOFFICIAL REMEDIES, 1928. Containing Descriptions of the Articles Which Stand Accepted by the Council on Pharmacy and Chemistry of the American Medical Association on January 1, 1928. Chicago: American Medical Association, 1928.

NURSES, PATIENTS AND POCKETBOOKS. Report of a Study of the Economics of Nursing Conducted by the Committee on the Grading of Nursing Schools. May Ayres Burgess, Director. New York: Committee on the Grading of Nursing Schools, 1928.

THE NOSE, THROAT AND EAR. By John F. Barnhill, M.D., F.A.C.S. New York and London: D. Appleton and Company, 1928.

THE EYE. C. W. Rutherford, M.D., F.A.C.S. New York and London: D. Appleton and Company, 1928.

INTERNATIONAL CLINICS; A QUARTERLY OF ILLUSTRATED CLINICAL LECTURES AND ESPECIALLY PREPARED ORIGINAL ARTICLES ON TREATMENT, MEDICINE, SURGERY, ETC. Edited by Henry W. Cattell, A.M., M.D., with the collaboration of others. Vol. ii. 38th series, 1928. Philadelphia and London: J. B. Lippincott Company, 1928.

ADDRESSES ON SURGICAL SUBJECTS. By Sir Berkeley Moynihan, Bart. Philadelphia and London: W. B. Saunders Company, 1928.

GYNECOLOGY. By William P. Graves, A.B., M.D., F.A.C.S. 4th ed. thoroughly rev. Philadelphia and London: W. B. Saunders Company, 1928.

METHODS AND PROBLEMS OF MEDICAL EDUCATION. 9th Series. New York: The Rockefeller Foundation, 1928.

BEITRAEGE ZUR KENNTNIS DER BECKENBRUECHE UND BECKENLUXATIONEN; KLINISCH-ROENTGENOLOGISCHE UNTERSUCHUNGEN UEBER DIE ANATOMIE, DEN ENTSTEHUNGSMECHANISMUS, DIE KOMPLIKATIONEN, DIE BEHANDLUNG UND DIE PROGNOSE. By Anders Westerborn. Uppsala: Almqvist & Wiksells, 1928.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

GEORGE D. STEWART, New York, *President* FRANKLIN H. MARTIN, Chicago, *Director-General*

BOSTON COMMITTEE ON ARRANGEMENTS

FREDERIC J. COTTON, *Chairman* CHARLES G. MIXTER, *Secretary*

JOHN D. ADAMS
NATHANIEL ALLISON
FRANKLIN G. BALCH
ALEXANDER S. BEGG
J. EMMONS BRIGGS
DAVID CHEEVER
ARTHUR L. CHUTE
J. H. CUNNINGHAM
HARVEY CUSHING
LINCOLN DAVIS
HILBERT F. DAY
GEORGE S. DERBY
F. W. DUCKERING
A. W. DUDLEY
DAVID EDSALL
JOEL E. GOLDTHWAIT
WILLIAM P. GRAVES
ROBERT B. GREENOUGH
OTTO J. HERMAN
DANIEL F. JONES
WILLIAM E. LADD
FRANK H. LAHEY
HALSEY B. LODER
FRED B. LUND
R. H. MILLER
W. J. MIXTER
H. P. MOSHER
DONALD MUNRO
FRANKLIN S. NEWELL
R. B. OSGOOD
WILLIAM C. QUINBY
CHARLES L. SCUDDER
JOSEPH L. STANTON
A. WARREN STEARNS
JAMES S. STONE
LORING T. SWAIN
HAROLD WALKER
WYMAN WHITTEMORE
HANS ZINSSER

PLANS FOR THE 1928 CLINICAL CONGRESS IN BOSTON

FOR the eighteenth annual Clinical Congress of the American College of Surgeons, to be held in Boston, October 8th to 12th, the clinicians of that city are keenly interested to present a program that will completely represent the clinical activities of that great medical center in all departments of surgery. The program is being prepared under the direction of a representative group of clinicians, with Dr. Frederic J. Cotton as Chairman of the Committee.

In the following pages is presented a preliminary program of clinics and demonstrations. These schedules are to be revised and amplified during the next two months. The real program of the Congress will be issued daily during the Congress —each afternoon there will be posted at headquarters in the form of bulletins a complete and accurate schedule of the clinics and demonstrations for the succeeding day. A printed program will be issued each morning. Clinics will be given in the various hospitals beginning at 2 o'clock on Monday afternoon, and will continue through the mornings and afternoons of the following four days.

General headquarters for the Congress will be established at the Statler Hotel where the ballroom, foyer, and other large rooms on the mezzanine floor have been reserved for use by the Congress for registration and ticket bureaus, bulletin boards, technical exhibits, executive offices, etc. The ballroom at the Copley-Plaza Hotel will be utilized for hospital conferences, evening meetings and other large gatherings.

A special feature of the program which will be of interest to all surgeons will be the celebration of Ether Day at the Massachusetts General Hospital on Friday. At the exercises to be held in the Dome Room in the old building of the hospital, where ether was first administered for the production of surgical anæsthesia on October 16, 1846, there will be presented to the hospital a bronze bust of William T. G. Morton.

Since the last session of the Clinical Congress a number of surgical films produced under the supervision of and approved by the American College of Surgeons have been completed and will be given a premier showing at the Boston meeting.

EVENING MEETINGS

There will be evening sessions on each of the five days. On Monday evening the Presidential Meeting will be held in Symphony Hall, on which occasion the President-Elect, Dr. Franklin H. Martin of Chicago, will be inaugurated and deliver the annual address. The Murphy Oration on Surgery will be delivered on the same evening by Professor Vittorio Putti, Professor of Orthopedic Surgery in the University of Bologna, Italy, and Director of the Rizzoli Institute. On Tuesday, Wednesday, and Thursday evenings, sessions will

be held in the ballroom of the Copley-Plaza Hotel. At the Wednesday evening meeting the visiting surgeons will be the guests of the Boston Surgical Society at a special meeting when the Bigelow Medal is to be awarded. On Friday evening the annual convocation of the College will be held in Symphony Hall when the 1928 class of candidates for Fellowship in the College will be received. The fellowship address will be delivered by Dr. William J. Mayo.

HOSPITAL CONFERENCE

An interesting series of papers, round table conferences and practical demonstrations that deal with many of the problems related to hospital efficiency is being prepared for the annual hospital conference which opens on Monday morning with a session in the ballroom of the Copley-Plaza Hotel. Morning and afternoon sessions in the same room are planned for Tuesday, Wednesday and Thursday.

A special session of the hospital conference on Wednesday afternoon will be devoted to a symposium dealing with the standardization of the ophthalmological and otolaryngological departments in general hospitals.

The program for the conference is planned to interest not only surgeons, but also hospital trustees, executives, and personnel generally, and an invitation is extended to all persons who are interested in hospital activities to attend the conference.

REDUCED RAILWAY FARES

The railways of the United States and Canada have authorized reduced fares on account of the Boston session of the Clinical Congress, so that the total fare for the round trip will be one and one-half the ordinary first-class one-way fare. To take advantage of the reduced rates it is necessary to pay the full one-way fare to Boston, procuring from the ticket agent when purchasing ticket, a "convention certificate" which certificate is to be deposited at headquarters for the visé of a special agent of the railways. Upon presentation of a viséed certificate to the ticket agent in Boston not later than October 16th a ticket for the return journey by the same route as traveled to Boston may be purchased at one-half the regular one-way fare.

In the eastern, central, and southern states and eastern provinces of Canada, tickets may be purchased between October 4th and 10th; in southwestern and western states between October 3d and 9th, and in the far western states and western provinces of Canada between September 30th and October 6th. The return journey from Boston must be begun not later than October 16th.

The reduction in fares does not apply to Pullman fares, nor to excess fares charged for passage on certain trains. Local railroad ticket agents will supply detailed information with regard to rates, routes, etc. Stop-overs on both the going- and return journeys may be had within certain limits.

Full fare must be paid from starting point to Boston, and it is essential that a "convention certificate" be obtained from the agent from whom the ticket is purchased. These certificates are to be signed by the general manager of the Clinical Congress and viséed by a special railroad agent in Boston during the meeting. No reduction in railroad fares can be secured except in compliance with the regulations outlined and within the dates specified. It is important to note that the return trip must be made by the same route as that used to Boston and that the certificate must be presented during the meeting and return ticket purchased and used not later than October 16th.

An exception to the above arrangement is to be noted in the case of persons traveling from points in the Pacific Coast states and British Columbia, who will be able to purchase round trip summer excursion tickets which will be on sale up to and including September 30th with a final return limit of October 31st. The summer excursion fare is somewhat lower than the convention fare mentioned above, but is available only in the Pacific Coast states and British Columbia. Tickets sold at summer excursion rates permit traveling to Boston via one direct route and returning via another direct route, with liberal stop-over privileges.

LIMITED ATTENDANCE—ADVANCE REGISTRATION

Attendance at the Boston session will be limited to a number that can be comfortably accommodated at the clinics, the limit of attendance being based upon the result of a survey of the amphitheaters, operating rooms, and laboratories in the hospitals and medical schools as to their capacity for accommodating visitors. Under this plan it will be necessary for those who wish to attend to register in advance.

Attendance at clinics and demonstrations will be controlled by means of special clinic tickets, which plan has proved an efficient means of providing for the distribution of visiting surgeons among the several clinics and insures against overcrowding, the number of tickets issued for any clinic being limited to the capacity of the room assigned to that clinic.

REGISTRATION FEE

A registration fee of $5.00 is required of each surgeon attending the annual Clinical Congress, such fee providing the funds with which to meet the expenses of the meeting. To each surgeon registering in advance a formal receipt for the registration fee is issued, which receipt is to be exchanged for a general admission card upon his registration at headquarters during the meeting. This card, which is nontransferable, must be presented to secure clinic tickets and admission to the evening meetings.

BOSTON HOTELS AND THEIR RATES

Since the last Clinical Congress in Boston in 1922, a number of new hotels have been built, including the Statler with 1300 guest rooms, the New Parker, and the Ritz Carlton. Some of the older hotels have been enlarged so that there are now ample first-class hotel accommodations in Boston for all who wish to attend. Many of these hotels are located within short walking distance of the headquarters hotels.

	Minimum Rates with Bath	
	Single Room	Double Room
Bellevue, 21 Beacon St.	$4.00	$7.00
Braemore, 464 Commonwealth Ave.	4.00	7.00
Brunswick, Boylston and Clarendon Sts.	3.50	5.00
Buckminster, 645 Beacon St.	3.00	4.00
Canterbury, 14 Charlesgate West.	4.00	5.00
Charlesgate, Charlesgate East, Marlboro and Beacon Sts.	3.00	5.00
Copley Plaza, Copley Square	4.00	7.50
Elks, 275 Tremont St.	3.50	5.00
Fensgate, 534 Beacon St.	4.00	5.00
Gralyn, 20 Charlesgate West.	3.00	5.00
Kenmore, 496 Commonwealth Ave.	3.50	6.00
Lenox, Exeter and Boylston Sts.	3.50	4.50
Lincolnshire, 20 Charles St.	4.00	6.00
New Parker, Tremont and School Sts.	3.50	5.50
Puritan, 390 Commonwealth Ave.	3.50	5.00
Ritz Carlton, Arlington and Newbury Sts.	5.00	8.00
Sheraton, 91 Bay State Road.	5.00	6.00
Somerset, 400 Commonwealth Ave.	3.00	5.00
Statler, Park Square at Arlington St.	3.50	5.50
Touraine, Boylston and Tremont Sts.	5.00	7.50
Vendome,* Commonwealth and Dartmouth	8.00	16.00
Victoria, Dartmouth and Commonwealth.	4.00	6.00
Westminster, Copley Square	3.00	5.00

*American plan.

PRELIMINARY CLINICAL PROGRAM

GENERAL SURGERY, GYNECOLOGY, OBSTETRICS, UROLOGY, ORTHOPEDICS

PETER BENT BRIGHAM HOSPITAL

Monday

HARVEY CUSHING—2:30. Neurosurgical clinic.
FRANCIS NEWTON—3:30. Diverticulitis.
CHANNING FROTHINGHAM—4. Passing of the chronic appendix.
E. S. EMERY, JR.—4:30. Study of the results of medical and surgical treatment of peptic ulcer.

Tuesday

Staff—9:30. Surgical operations.
H. A. CHRISTIAN—2:30. Medical diagnostic and therapeutic clinic.
GILBERT HORRAX—3:30. Cordotomy for the relief of pain.
J. P. O'HARE—4. Hypertension and nephritis in relation to surgery.
DAVID CHEEVER—4:30. Surgical diagnostic clinic.

Wednesday

Staff—9:30. Surgical operations.
M. P. SOSMAN—2:30. X-ray study of massive atelectasis of the lung.
G. P. GRABFIELD—3. Effect of drugs on the nitrogen metabolism.
JOHN HOMANS—3:30. Treatment of varicose ulcer.
S. A. LEVINE—4. Heart disease in surgery.
S. B. WOLBACH—4:30. Demonstration in surgical pathology.

Thursday

Staff—9:30. Surgical operations.
W. C. QUINBY—2:30. Surgical clinic.
R. H. FITZ—3. Insulin in surgical conditions.
WILLIAM MURPHY and JOHN POWERS—3:30. Treatment of secondary anæmia by liver diet.
HARVEY CUSHING and TRACY PUTNAM—4. Pituitary gland and its influence on growth.

MASSACHUSETTS GENERAL HOSPITAL

Monday

Orthopedic service—2. Dry clinics.
NATHANIEL ALLISON. Tuberculosis of the knee.
P. D. WILSON. Tuberculosis of the spine.
DR. M. N. SMITH-PETERSON. Tuberculosis of sacro-iliac.
R. K. GHORMLEY. Internal derangement of knee joint.
NATHANIEL ALLISON and DR. KLEIN. Congenital dislocation of hip.
Surgical service—2. Dry clinics.
J. H. MEANS, E. P. RICHARDSON and GEORGE HOLMES. The thyroid.
GEORGE MCIVER. Burns.
DRS. WHITE and SPRAGUE. The heart in surgery.
C. M. JONES. The gall bladder.
J. H. MEANS. Surgical cases.

Tuesday

J. D. BARNEY and staff—9. Genito-urinary operations.
Surgical service—11. Surgical operations.
D. F. JONES—2. Dry clinic: Cancer of gastro-intestinal tract.
C. A. PORTER—2. X-ray burns.
W. J. MIXTER, J. B. AYER and J. S. HODGSON—2. Surgery of the nervous system, operations and demonstrations.
J. V. MEIGS—2. Uterine bleeding, etc.
L. S. MCKITTRICK—2. Radium in cancer of the rectum.
ARTHUR ALLEN and R. H. SMITHWICK—2. Circulatory diseases of the extremities; postoperative pulmonary infections.

Wednesday

DRS. WYMAN WHITTEMORE, CHURCHILL and LORD—9. Thoracic surgery, operations.
R. C. CABOT and MISS CANNON—2. Social service.
DR. BREWSTER—2. Surgical clinic.
DR. LLOYD and associates—2. Syphilis and surgery.
F. A. WASHBURN—2. Early days of the Massachusetts General Hospital, first ether anæsthesia.
DR. SIMMONS—2. Surgical cases.
WILLIAM HERMAN—2. Psychiatry and surgery.
DR. HOLMES and associates—2. Demonstration in X-ray department.

Thursday

Orthopedic service—9. Operations and demonstration of cases.
DRS. WILSON and DANFORTH. Arthritis of spine.
NATHANIEL ALLISON and DR. COONSE. Arthritis of knee.
WILLIAM ROGERS and DR. STRAUMER. Arthritis of hip.
R. K. GHORMLEY and DR. LOW. Poliomyelitis.
WILLIAM ROGERS. End-result studies.
Fracture service—2. Demonstration of cases.
DRS. VINCENT and A. V. BOCK—2. Dry clinic: The spleen.
E. P. RICHARDSON—2. Hernia through cardiac orifice of diaphragm.
LINCOLN DAVIS—2. Cancer of cæcum, duodenum and gall bladder.
DR. HANFORD (Presbyterian Hospital, New York) and RICHARD MILLER—2. Clinic on surgical tuberculosis.
DR. DALAND—2. Clinic on plastic surgery.
DR. SHEDDEN—2. Surgical clinic.

Friday

Staff—9. Surgical operations.
G. A. LELAND—12. Fascia repair of hernia.
DRS. C. A. PORTER, BREWSTER, JONES, DAVIS, RICHARDSON and WILLIAMS—11. Surgical clinic.
R. B. GREENOUGH and associates—2. Tumor clinic.
DR. MCINVER—2. Gastro-intestinal surgery.
DR. WILLIAMS—2. Gall-bladder surgery.
DR. AUB—2. Clinic on occupational diseases; calcium metabolism in bone.
A. V. BOCK—2. Surgical clinic.
DR. HARMER—2. Surgical clinic.

CAMBRIDGE HOSPITAL

Tuesday

Staff—9. General surgical clinics, operations and demonstration of cases.

Wednesday

J. W. SEVER and F. A. FINDLAY—9. Orthopedic clinic, operations and demonstration of cases.

Friday

Staff—9. General surgical clinics, operations and demonstration of cases.

HARVARD MEDICAL SCHOOL

Monday

DRS. GAMBLE and KEEVER—2. Acid base factors in pyloric and duodenal obstruction in children.

DRS. WOLBACH and BLACKFAN—2. Hæmatological studies with special reference to splenectomy in children.

BRONSON CROTHERS—2. Studies of injuries to the spinal cord in infants.

W. L. MOSS and DR. ELEY—2. Studies concerning blood transfusion.

LLOYD D. FELTON—2. Pneumococcus antibody solution, methods and uses.

W. LLOYD AYCOCK and E. H. LUTHER—2. Infantile paralysis: modes of spread, use of convalescent serum, experiments in immunity, and epidemiology of the disease.

M. J. ROSENAU and H. B. ANDERVENT—2. Filterable viruses, experiments on encephalitis, herpes and vaccine virus.

W. B. CANNON—2. Complete denervation of heart; effects of total sympathectomy.

ALEX. FORBES and HALLOWELL DAVIS—2. Demonstration in laboratory, electrical methods for analyzing functions of nerve tissue.

The new electrophysiology center will be open for inspection to any who are interested in the physiology of the nervous system.

Tuesday

DRS. GAMBLE and KEEVER—2. Acid base factors in pyloric and duodenal obstruction in children.

DRS. WOLBACH and BLACKFAN—2. Hæmatological studies with special reference to splenectomy in children.

BRONSON CROTHERS—2. Studies of injuries to the spinal cord in infants.

W. L. MOSS and DR. ELLEY—2. Studies concerning blood transfusion.

L. W. SMITH—2. Pathology of the thyroid gland.

C. L. CONNOR—2. The behavior of certain tumors of fowls when transplanted to bone; studies in carotin, its occurrence, its preparation in pure forms, results of injection and feeding experiments.

HENRY PINKERTON—2. The behavior of oils and fats in the lungs; the pathology of the splenomegalies in childhood.

SHIELDS WARREN—2. The prevention of peritoneal adhesions by amniotic fluid, experimental and clinical results.

M. J. SHLESINGER—2. The effects of hæmatoporphyrin on animals.

DRS. WOLBACH and HOWE—2. The pathology of the deficiency diseases, with special reference to scorbutus, rachitis and vitamin-A deficiency (xerophthalmia).

Wednesday

LLOYD D. FELTON—2. Pneumococcus antibody solution, methods and uses.

W. LLOYD AYCOCK and E. H. LUTHER. Infantile paralysis, modes of spread, the use of convalescent serum, experiments in immunity, and epidemiology of the disease.

J. W. SCHERESCHEWSKY—2. Cancer, the use of high frequency currents.

M. J. ROSENAU and H. B. ANDERVENT. Filterable viruses, experiments on encephalitis, herpes and vaccine virus.

W. B. CANNON—2. Complete denervation of the heart; effects of total sympathectomy.

ALEX. FORBES and HALLOWELL DAVIS. Demonstration in laboratory; electrical methods for analyzing the functions of nerve tissue.

PHILIP DRINKER—2. New methods of artificial respiration.

CECIL K. DRINKER and STEPHEN WENT—2. New colloid solutions for intravenous injections as substitutes for simple salt solutions.

LOUIS A. SHAW—2. Experiments on the exchange of gases through normal tissues.

STANLEY COBB—2. Microscopic demonstration of capillary injection of the brain.

H. S. FORBES—2. Demonstration of the cerebral circulation in living cats.

Thursday

L. W. SMITH—2. Pathology of the thyroid gland.

C. L. CONNOR—2. The behavior of certain tumors of fowls when transplanted to bone; studies on carotin, its occurrence, its preparation in pure form; results of injection and feeding experiments.

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DRS. WOLBACH and HOWE—2. The pathology of the deficiency diseases with special reference to scorbutus, rachitis and vitamin-A deficiency (xerophthalmia).

EDWIN J. COHN—2. The interaction between proteins and electrolytes, or the more special problem concerned with the nature "of the material in liver effective in pernicious anæmia."

STANLEY COBB—2. Microscopic demonstration of capillary injection of the brain.

H. S. FORBES—2. Demonstration of the cerebral circulation in living cats.

Friday

Conferences in general surgery, orthopedics, genito-urinary surgery, gynecology and obstetrics, from 9 to 12.

THORNDIKE MEMORIAL—BOSTON CITY HOSPITAL

Tuesday and Thursday, 2:30

GEORGE R. MINOT. Treatment of pernicious anæmia.

DRS. MINOT, WEARN and others. Epilepsy; capillary circulation; achylia gastrica; anæmia and disorders of the blood; cardiovascular diseases; metabolism; bacteriology.

R. P. STRONG. Demonstration of certain tumors of parasitic origin.

G. C. SHATTUCK. Lecture on tropical diseases of surgical interest.

SURGICAL LABORATORY—MASSACHUSETTS GENERAL HOSPITAL

Tuesday and Thursday, 2

M. A. MCIVER. Experimental problems in connection with intestinal obstruction.

J. C. WHITE. Subject to be announced.

R. H. SMITHWICK. Circulatory disorders of the extremities.

MASSACHUSETTS GENERAL HOSPITAL

Wednesday, 9

A. V. BOCK. Studies on the physiology of muscular work in health and disease.

J. C. AUB. Investigations in calcium metabolism bearing on bone growth and repair.

W. O. THOMPSON. Studies on thyroid disease; iodine dosage in exophthalmic goiter, thyroxin in myxœdema.

C. M. JONES. Acid and base secretions by the stomach; reference of pain from the gastro-intestinal tract.

WARREN MUSEUM

Open daily from 2 to 4 p.m.

Demonstrations by DR. M. CANAVAN, Curator

Dwight collection of spines illustrating deformities, anomalies, diseases.

Bone tumors, with X-ray, histories, and microscopic slides and microscopes available for examination. Some of these specimens were used in the illustrations in the monograph on "Bone Sarcoma" issued by the American College of Surgeons.

Models showing various types of club feet and effects of operation.

The pictures in Dr. Nichols' collection illustrating pathological conditions of bone.

Fractures and dislocations of bones as they existed before industrial plants provided so many safeguards.

Tuberculosis of bones and joints.

Syphilis of bones.

Dislocation of ends of bones.

Collection of old surgical instruments, obstetrical forceps, turn keys for extracting teeth, urological tools, cupping and leeching instruments.

CHILDREN'S HOSPITAL

Monday

R. B. OSGOOD, W. E. LADD and associates—2. Fracture conference, combined surgical and orthopedic services.

Tuesday

Surgical staff—9. General surgical operations followed by dry clinic.
WILLIAM E. LADD. Hare lip and cleft palate.
C. G. MIXTER. Contractures and plastics.
H. W. HUDSON. Angiomata.
G. D. CUTLER and KENNETH BLACKFAN. Medical aspects of empyema and lung abscess.
Orthopedic staff—2. Dry clinic, infantile paralysis.
W. L. AYCOCK and E. H. LUTHER. Epidemiology, occurrence, serum treatment.
S. M. FITCHET. Demonstration of apparatus for prevention of deformity in early cases.
MISS MERRILL. Muscle training.
FRANK OBER. Tendon transplantation.
E. W. RYERSON (Chicago) and A. T. LEGG. Stabilizing operations.
A. T. LEGG. Operations.
FRANK OBER. Moving pictures.

Wednesday

W. E. LADD, R. B. OSGOOD and associates—9. Combined clinic of surgical and orthopedic services, present policies in the treatment of glandular, intra-abdominal, bone, and joint tuberculosis.
R. B. OSGOOD, W. E. LADD and associates—2. Combined clinic of surgical and orthopedic services, osteomyelitis, acute, chronic, circumscribed; Brodie's abscess; septic joints; types of infection and treatment.

Thursday

Orthopedic staff—9. Dry clinic.
ALFRED TAYLOR (New York) and J. W. SEVER. Conference on obstetrical paralysis with lantern slides and moving pictures.
FREEMAN ALLEN, F. SMITH (New York), W. B. CANNON and A. H. BREWSTER. Conference on spastic palsy.
BRONSON CROTHERS and MISS TRAINOR. Muscle training.
A. H. BREWSTER. Stoeffel operation.
Surgical staff—2. General surgical operations followed by dry clinic.
C. G. MIXTER. Urinary obstruction and infection.
W. E. LADD. Kidney stone.
THOMAS LANMAN. Hernia and undescended testicle.
C. G. MIXTER and S. B. WOLBACH. Kidney tumors, pathological aspects.

Friday

Surgical staff—9. General surgical operations followed by dry clinic.
WILLIAM E. LADD. Pyloric stenosis.
G. D. CUTLER. Idiopathic peritonitis.
AUGUSTUS THORNDIKE. Appendicitis.
C. G. MIXTER. Intussusception.
WILLIAM E. LADD. Obliteration of bile ducts.
Orthopedic staff—2. Dry clinic.
ELLIOTT G. BRACKETT (Cincinnati) and H. J. FITZSIMMON. Conference on torticollis followed by operation.
F. D. DICKSON (Kansas City) and R. SOUTTER. Conference on congenital dislocation of hip followed by closed reduction and shelf operation.

HUNTINGTON MEMORIAL HOSPITAL

Wednesday—2, Dry clinics

E. M. DALAND and G. W. TAYLOR. Carcinoma of the skin.
C. C. SIMMONS and C. C. LUND. Cancer of the tongue and buccal mucosa.
G. A. LELAND and J. V. MEIGS. Carcinoma of the cervix.
R. B. GREENOUGH and C. C. SIMMONS. Varying degrees of malignancy in cancer.
WILLIAM M. SHEDDON and E. P. HAYDEN. Cancer of the rectum.
E. M. HERMAN and H. V. KAZANJIAN. Cancer of the antrum and accessory sinuses.

Thursday—2, Dry clinics

WILLIAM DUANE and J. C. HUDSON. The modern X-ray plant.
E. M. DALAND and WILLIAM M. SHEDDON. Cancer of the lip.
G. G. SMITH. Carcinoma of the genito-urinary tract.
R. B. GREENOUGH and C. C. SIMMONS. Carcinoma of the breast.
C. C. SIMMONS. Malignant bone tumors.
E. M. DALAND and C. C. LUND. Electrocoagulation in the treatment of malignant disease.

CLINICS ON INDUSTRIAL SURGERY

At these clinics, to be held in the office of the Medical Director of the American Mutual Liability Insurance Company, cases will be shown to illustrated diagnosis, treatment and end-results.

Tuesday

ERNEST A. CODMAN—2. Shoulder injuries.
EDWARD L. YOUNG—4. Inguinal pain without hernia.

Wednesday

P. D. WILSON—2. Fractures of the os calcis; injuries to the knee.
RUDOLPH JACOBY—4. Industrial dermatology.

Thursday

FRED J. COTTON—2. Reconstruction surgery in industry.
JOHN D. ADAMS—4. Injuries to the back.

Friday

JOHN D. HODGSON—2. Fracture of the skull.
HARRY C. SOLOMON—3. Industrial neurology.
HENRY C. MARBLE—4. Hernia.

LONG ISLAND HOSPITAL

Monday

J. H. CUNNINGHAM and C. S. SWAN—2. Genito-urinary clinic, operations and demonstration of cases.
LAWRENCE W. SMITH—2. Pathological demonstration.
HENRY VIETS—2. Neurosurgical cases.
A. B. MACMILLAN—2. X-ray demonstration.

Wednesday

ROBERT SOUTTER—2. Orthopedic clinic, operations and demonstration of cases; traction in the treatment of fractures; treatment of congenital hip.
LAWRENCE SMITH—2. Pathological demonstration.
HENRY VIETS—2. Neurosurgical cases.
A. B. MACMILLAN—2. X-ray demonstration.
CHARLES LUND—2. Injection treatment of varicose veins; operations and demonstration of cases.

Friday

J. H. CUNNINGHAM and C. S. SWAN—2. Genito-urinary operations.
ROBERT SOUTTER—2. Orthopedic operations.
CHARLES LUND—2. General surgical operations.
LAWRENCE SMITH—2. Pathological demonstration.
HENRY VIETS—2. Neurosurgical cases.
A. B. MACMILLAN—2. X-ray demonstration.

ST. ELIZABETH'S HOSPITAL

Tuesday

G. F. KEENAN—9. Surgical clinic: Appendectomy; hysterectomy.
JOSEPH STANTON—9. Surgical clinic: Thyroid cases; gastro-enterostomy.
W. F. DOLAN—9. Surgical clinic: Inguinal hernia.
C. J. KICKHAM—9. Prolapse of uterus.
F. T. JANTZEN—9. Inguinal hernia under local anæsthesia.
H. S. ROWEN—9. Appendectomy.
A. L. CHUTE and B. D. WETHERELL—2. Dry clinic: Genito-urinary cases, end-results and unusual roentgenograms.
T. J. SCANLAN—2. Gynecological examinations.
PIERCE DUNPHY—2. Cases of cancer of cervix; operation and X-ray therapy, one to four years after operation.
PIERCE MCGANN—2. Postoperative hypospadias.

Wednesday

F. T. JANTZEN—9. Surgical clinic: Appendectomy; cholecystectomy.
G. F. KEENAN—9. Surgical clinic: Cholecystectomy.
PIERCE DUNPHY—9. Perineal plastic; cæsarean section.
JOSEPH STANTON—9. Thyroid cases.
R. SULLIVAN—9. Knee cartilage.
T. F. BRODERICK—9. Reconstruction of hip; plastic on knee joint.
T. F. BRODERICK and R. F. SULLIVAN—2. Dry clinic: End-results in spinal fusion for tuberculosis, scoliosis, and anatomical anomalies; end-results in plastic cases for relief of deformity.
F. T. JANTZEN—2. End-results in fractures, operative and non-operative; colloidal lead treatment for malignant diseases.
DR. HEALEY—2. Interesting roentgenograms.
JOHN DUNPHY—2. Surgical aspects of pediatrics.

Thursday

T. F. BRODERICK—9. Surgical clinic: Spinal fusion.
A. L. CHUTE—9. Prostatectomy; tumor of bladder; nephrectomy.
JOSEPH STANTON—9. Gastro-enterostomy; cholecystectomy; appendectomy.
H. S. ROWEN—9. Hysterectomy.
G. F. KEENAN—9. Ovarian cyst.
A. H. CROSBIE—9. Nephrectomy.
JOSEPH STANTON—2. Dry clinic: Hour-glass stomach; fibroma of colon, with intermittent intussusception; carcinoma of appendix.
J. J. SULLIVAN—2. Toxæmia following administration of alkalies for treatment of duodenal ulcer.
L. J. LOUIS—2. Postoperative pancreatic cyst.
H. S. ROWEN—2. Surgical cases.

Friday

L. J. LOUIS—9. Surgical clinic: Appendectomy; cholecystectomy.
H. S. ROWEN—9. Cholecystectomy.
JOSEPH STANTON—9. Appendectomy; hysterectomy.
G. F. KEENAN—9. Ventral hernia; appendectomy.
C. J. KICKHAM—9. Cæsarean section.
F. T. JANTZEN—9. Inguinal hernia under local anæsthesia.
G. F. KEENAN—2. Dry clinic: Postoperative fracture of skull; postoperative extensive resection of chest.
M. H. SPELLMAN—2. End-results in fractures of skull.

ROBERT BRIGHAM HOSPITAL

Tuesday

H. A. NISSEN—2. Focal infection in chronic arthritis; gastro-intestinal studies.
H. T. SWAIM—3. Types of arthritis with X-ray studies and orthopedic principles in the treatment.

Wednesday

P. D. WILSON—2. Operation for knee deformities.
H. T. SWAIM—3. Demonstration of orthopedic apparatus.

Thursday

L. M. SPEAR—2. Circulatory conditions in arthritis.
L. T. BROWN—3. Mechanical conditions of the low back.

Friday

P. D. WILSON—2. Orthopedic operations and demonstration of cases; orthopedic principles in the treatment of chronic arthritis.

BOSTON DISPENSARY

Tuesday

H. J. INGLIS—2. Lipiodol injections in the diagnosis of bronchiectasis and lung abscess as used in out-patient department.
ARTHUR H. CROSBIE and HAROLD CHAMBERLIN—2. Cystoscopy and demonstration of cases.
JOSEPH H. PRATT—2. Dry clinic, importance of the physician to the surgeon, illustrated by cases.

Wednesday

JOHN D. ADAMS—11. Orthopedic operations.
HILBERT F. DAY—11. Injection treatment of varicose veins; demonstration of technique, cases and pathological specimens.
HARRY FRIEDMAN—11. Demonstration of malignancies treated by radium and X-ray therapy.

Thursday

A. K. PAINE—2. Treatment of gonorrhœa in women.
WILLIAM A. HINTON—2. Hinton-cholesterol reaction; demonstration of technique and relative sensibility.
MAYNARD LADD—2. Surgical aspects of pyloric stenosis in infants.

BOSTON CITY HOSPITAL

Monday

N. R. MASON, R. M. GREEN, G. T. WILLIAMS, F. L. GOOD, J. P. COHEN, H. V. HYDE and F. J. LYNCH—2. Gynecological and obstetrical clinic, operations and demonstration of cases.

Tuesday

H. BINNEY, A. R. KIMPTON, H. H. HOWARD, G. W. PAPEN, D. D. SCANNELL, S. FRASER, J. J. HEPBARN and T. W. WICKHAM—9. Surgical clinic, operations and demonstration of cases.

Surgical Services I and III—2. Dry clinic.

F. W. WHITE—2. Intussusception of the bowel occurring within the stomach following gastro-enterostomy.

G. C. SHATTUCK—2. Surgical aspects of some tropical maladies.

Wednesday

H. B. LODER, J. J. WALKER, F. F. HENDERSON, E. HARDING, J. C. HUBBARD, R. C. COCHRANE, D. MUNRO, A. RILEY and T. RICHARDS—9. Surgical clinic, operations and demonstration of cases.

Surgical Services II and V—2. Dry clinic.

G. R. MINOT and J. T. WEARN—2. Dry clinic.

W. R. OHLER—2. The care of the surgical diabetic.

F. B. MALLORY—2. Pathological demonstration.

Thursday

F. J. COTTON, O. J. HERMAN, J. H. SHORTALL and W. MORRISON—9. Surgical clinic, operations and demonstration of cases.

D. MUNRO and TRACY PUTNAM—9. Neurosurgical operations.

Surgical Service IV—2. Dry clinic: Neurosurgical cases.

S. COBB and A. MYERSON—2. Neurological clinic.

B. BUTLER—2. X-ray demonstration.

Friday

F. B. MALLORY, P. F. BUTLER, F. J. COTTON, R. W. ANDREWS and others—9. Conferences and presentation of special subjects.

CARNEY HOSPITAL

Monday

A. R. MACAUSLAND—2. Dry clinic: Traumatic injuries of the hip joint, illustrated.

H. G. LEE—2. Dry clinic: Fractures of the femoral shaft and of the table of tibia; wrist joint arthroplasties.

D. F. MAHONEY—2. Dry clinic: Radical operations for carcinoma of the breast and perforating duodenal ulcer, with presentation of cases.

Tuesday

F. B. LUND, A. MCK. FRASER and associates—9. Surgical operations.

F. W. JOHNSON, L. E. PHANEUF and associates—9. Gynecological and obstetrical operations.

A. L. BRETT—2. Dry clinic: Ununited fracture of neck of femur; bone screws in fractures; fusion of spine.

F. B. LUND, E. J. DENNING and W. E. BROWNE—2. Dry clinic: Chronic duodenal ulcer.

F. W. JOHNSON—2. Dry clinic: End-results following interposition operation for uterine prolapse (lantern slides).

Wednesday

D. F. MAHONEY, W. E. BROWNE and associates—9. General surgical operations.

F. W. JOHNSON, L. W. PHANEUF and associates—9. Gynecological and obstetrical operations.

P. N. JEPSON—2. Dry clinic: Relative value of various types of operative bone splinting, including the massive bone graft; treatment of chronic arthritis of the spine, operative and nonoperative; incidence, recognition and treatment of spondylolisthesis; over-correction of deformities in fractures.

A. MCK. FRASER—2. Dry clinic: Cæcostomy in acute appendicitis with peritonitis, presentation of cases.

L. E. PHANEUF—2. Dry clinic: The low or cervical cæsarean section (lantern slides).

Thursday

F. B. LUND, A. MCK. FRASER and associates—9. General surgical operations.

F. W. JOHNSON, L. F. PHANEUF and associates—9. Gynecological and obstetrical operations.

W. R. MACAUSLAND—2. Dry clinic: Mobilization of the knee and elbow.

M. H. BLOOMBERG—2. Dry clinic: Scoliosis and club foot.

E. J. DENNING—2. Dry clinic: Postoperative medical problems; pre-operative treatment in cardiac cases.

L. E. PHANEUF—2. Dry clinic: Uterine bleeding (lantern slides).

Friday

D. F. MAHONEY, W. E. BROWNE and associates—9. General surgical operations.

F. W. JOHNSON, L. E. PHANEUF and associates—9. Gynecological and obstetrical operations.

A. SARGENT and B. A. GODVIN—2. Orthopedic clinic.

E. J. DENNING—2. Dry clinic: Intestinal parasites in immigrants.

W. E. BROWNE—2. Dry clinic: Fractures and injuries of the hand and forearm with presentation of special splints.

L. E. PHANEUF—2. Dry clinic: Appendicitis and pregnancy.

MASSACHUSETTS HOMEOPATHIC HOSPITAL

Monday

T. E. CHANDLER and H. J. LEE—2. General surgical clinic: Operations and demonstration of cases.

Tuesday

C. T. HOWARD and C. CRANE—9. Surgical operations.

R. C. WIGGIN and S. N. VOSE—9. Urological operations.

S. W. ELLSWORTH—10. X-ray demonstration.

S. R. MEAKER—10. Gynecological clinic.

J. E. BRIGGS and W. K. S. THOMAS—2. General surgical operations.

Wednesday

T. E. CHANDLER and C. D. HARVEY—9. Surgical operations.

A. G. HOWARD, S. L. MARNOY and L. G. HOWARD—9. Orthopedic operations.

C. T. HOWARD and H. J. LEE—2. Surgical operations.

L. F. JOHNSON—2. Bronchoscopic clinic.

Thursday

J. E. BRIGGS and C. CRANE—9. Surgical operations.

S. R. MEAKER—10. Gynecological clinic.

S. W. ELLSWORTH—10. X-ray demonstration.

C. T. HOWARD and W. K. S. THOMAS—2. Surgical operations.

Friday

T. E. CHANDLER and C. CRANE—9. Surgical operations.

J. E. BRIGGS and H. J. LEE—2. Surgical operations.

FREE HOSPITAL FOR WOMEN

Monday

Dry clinic—2. Discussion of new problems in gynecology.

Tuesday

Operative clinic—9. Amputation of cervix and cœliotomy, first stage of procidentia; perineorrhaphy, second stage of procidentia; hysterectomy for fibroids; dilatation and curettage, cœliotomy for retroversion.

Wednesday

Operative clinic—9. Plastic and cœliotomy, reconstruction operation; hysterectomy for fibroids; dilatation and curettage, cœliotomy for retroversion; perineorrhaphy for complete laceration of perineum.

Thursday

Operative clinic—9. Amputation of cervix and cœliotomy for procidentia; plastic and cœliotomy for prolapse; hysterectomy for fibroid; closure of vesicovaginal fistula.

Friday

Operative clinic—9. Hysterectomy for cancer; dilatation and curettage and application of radium for cancer.
Dry clinic—9. Demonstration of cancer cases treated.

NEW ENGLAND HOSPITAL FOR WOMEN AND CHILDREN

Tuesday

L. D. Adams, B. L. Atwood and Grace Rochford—9. Gynecological operations.
B. L. Atwood, E. Macnaughton, Marion Nute—9. Cæsarean section; operative deliveries if available.

Wednesday

Marion Nute—9. Demonstration of unusual obstetrical cases; nursery and ward walk; prenatal clinic.
L. D. Adams, B. L. Atwood and Grace Rochford—9. Gynecological operations.

Thursday

Grace Rochford and Olga Leary—9. Demonstration of postoperative cases; pathological specimens.
Eveline B. Lyle and E. Wright—9. Demonstration of border-line cases.

FORSYTH DENTAL INFIRMARY

Staff—2, daily. Surgical clinics, cleft palate operations, root resections. Demonstrations in research laboratories; effect of various diets on bone development and repair.

TUFTS COLLEGE MEDICAL SCHOOL

Timothy Leary—2, daily. Demonstration of specimens illustrating results of traumatism, especially cranial and cerebral.

NEW ENGLAND BAPTIST HOSPITAL

Tuesday

E. L. Young, Jr., D. L. Jackson, H. B. Loder and D. J. Bristol, Jr.—9. General surgical clinic, operations and demonstration of cases.

Wednesday

F. H. Lahey and H. M. Clute—9. Surgical operations.
Sara M. Jordan and E. Kiefer—2. Gastro-enterological clinic.

Thursday

E. L. Young, Jr., D. L. Jackson, H. B. Loder and D. J. Bristol, Jr.—9. General surgical clinic: operations and demonstration of cases.

BOSTON LYING-IN HOSPITAL

Tuesday

Staff—9. Dry clinics.
B. E. Hamilton. Heart disease in pregnancy.
F. S. Newell. Treatment of pregnancy complicated by heart disease.
S. Berman. End results in pre-eclamptic toxæmia.
F. C. Irving. Treatment of pre-eclamptic toxæmia by the removal of blood plasma and the reinfusion of corpuscles.
E. G. Crabtree. Clinical aspects of pyelitis in pregnancy.
G. C. Prather. The postpartum bladder.

Wednesday

Staff—9. Obstetrical operations.

NEW ENGLAND DEACONESS HOSPITAL

D. F. Jones, Frank H. Lahey, A. M. Chute and Leland McKittrick—9, daily. General surgical clinic: Operations and demonstration of cases.
Staff—2, daily. Dry clinic: Surgery of diabetics; diabetes and thyroidism; gastric and duodenal ulcer.

BETH ISRAEL HOSPITAL

Wyman Whittemore and associates—9, daily. General surgical clinic.
E. G. Crabtree—9, daily. Urological clinic.
Mark Rogers—9, daily. Orthopedic clinic.
Herman Blumgard. Demonstration in medical research department.

BOSTON UNIVERSITY SCHOOL OF MEDICINE

(Evans Memorial Building)

S. R. Meaker and A. W. Rowe—2, Wednesday and Friday. Studies in sterility.
A. W. Rowe and C. H. Lawrence—2, Wednesday and Friday. Endocrinology.

SURGERY OF THE EYE, EAR, NOSE, AND THROAT

MASSACHUSETTS EYE AND EAR INFIRMARY

Tuesday

Ophthalmology

Staff—9. Operations and demonstrations of cases.
J. M. Wheeler. Plastic surgery.
G. S. Derby. Eye operations.
W. H. Lowell. Muscles.
J. H. Waite. Slit-lamp demonstration.
E. B. Dunphy. External diseases.
R. C. Cheney. Perimetry.
H. K. Messenger. Physiologic optics.
P. A. Chandler. Light sense.
T. L. Terry. Pathology.
Ida E. Ridgeway. Sight-saving class.

Otolaryngology

Philip Hammond—9. Simple and radical mastoid operation.
H. A. Barnes—9. Dry clinic: Malignant diseases of the accessory sinuses, exhibition of patients.
H. P. Cahill—10. Dry clinic: Wire gauze brain drain; paraffin basket for skin graft of radical mastoid cavity; lantern slides of brain cases.
G. H. Tobey—11. Dry clinic: Lateral sinus thrombosis; the manometer test.
C. B. Faunce—2. Dry clinic: Lipiodol injections in brain abscess.
D. C. Smyth—3. Dry clinic: Lipiodol injections in lung abscess.

Wednesday

Otolaryngology

G. H. Poirier—9. Mosher-Toti lachrymal sac operation.
F. A. Simmons—10. Tonsillectomy cases, dissection and snare.
G. H. Poirier. Sluder technique.
H. P. Cahill. LaForce technique.
P. E. Meltzer. Removal with cautery snare.
A. S. MacMillan—11. Dry clinic: Demonstration of accessory sinus and mastoid X-rays.

Ophthalmology

Staff—9. Operations and demonstrations of cases.
W. B. Lancaster. Eye operations.
J. B. Ayer and G. S. Derby. Nerve-eye clinic.
Maude Carvill. Ocular tuberculosis.
J. H. Waite. Gullstrand ophthalmoscope.
P. A. Chandler. Perimetry.
B. Sachs. External diseases.
H. K. Messenger. Physiologic optics.
P. A. Chandler. Light sense.
T. L. Terry. Pathology.
Ida E. Ridgeway. Sight-saving class.

Thursday

Otolaryngology

V. H. Kazanjian—9. Plastic operations.
D. C. Smyth—9. Dry clinic: Fluoroscope and removal of metallic foreign bodies.
H. P. Mosher—10. Dry clinic: Exhibition of œsophageal instruments; demonstration of fluoroscopic examination of the œsophagus.
A. S. MacMillan—11. Dry clinic: Lantern slide demonstration of œsophageal cases.
Dr. Kirby—2. Demonstration of Bárány tests.
F. E. Garland—3. Dry clinic: Infection of the submaxillary gland.

Ophthalmology

Staff—9. Operations and demonstrations of cases.
T. B. Holloway. Thyroid-eye cases.
A. Greenwood. Eye operations.
S. J. Beach. Refraction with angular type.
W. B. Lancaster. Muscles.
H. B. C. Riemer. External diseases.
E. B. Dunphy. Perimetry.
H. K. Messenger. Physiologic optics.
P. A. Chandler. Light sense.
T. L. Terry. Pathology.
Ida E. Ridgeway. Sight-saving class.

Friday

Ophthalmology

Staff—9. Operations and demonstrations of cases.
F. H. Verhoeff. Eye operations.
H. B. C. Riemer. Tear sac cases: congenital, acute, chronic.
Amy Smith. Social work.
H. K. Messenger. Physiologic optics.
P. A. Chandler. Light sense.
T. L. Terry. Pathology.
Ida E. Ridgeway. Sight-saving class.

Otolaryngology

V. H. Kazanjian—9. Dry clinic: Correction of deformities of the face and nose, lantern slide demonstration.
H. P. Mosher—10. Dry clinic: Punch tracheotomy.
A. S. MacMillan. X-ray of thymus (lantern slides).
F. E. Garland—11. Historical exhibit of laryngeal instruments.
H. P. Cahill—2. Dry clinic: Lantern slide demonstration of serial sections of the ear.
D. H. Walker—3. Dry clinic: Lip reading and the deaf child.

MASSACHUSETTS HOMEOPATHIC HOSPITAL

Tuesday

W. D. Rowland—9. Eye clinic.
F. W. Colburn and H. L. Babcock—9. Aural clinic.

Thursday

W. D. Rowland—9. Eye clinic.
C. Smith, C. W. Bush, E. R. Johnson, R. O. Parris and W. W. Walker—9. Nose and throat clinic.

Friday

W. D. Rowland, J. E. Sternberg, H. M. Emmons and J. J. Skirball—9. Eye clinic.

BOSTON DISPENSARY

Tuesday

H. J. Inglis—2. Beck-Schenk snare method of tonsillectomy.

Wednesday

Joseph J. Skirball—11. Eye clinic, demonstration of cases, external diseases, perimetry, ophthalmological co-operation with syphilis clinic.

HARVARD MEDICAL SCHOOL

Monday

H. P. MOSHER—2. Laryngological demonstration: Casts of the adult œsophagus; wet specimens showing the œsophagus at birth; cadaver demonstration of the Mosher-Toti lachrymal sac operation; teaching methods used in post-graduate instruction in laryngology.

Tuesday

G. S. DERBY—2. Ophthalmological demonstrations: Active research, demonstrations of what the pathological laboratory is doing and has done in the past; demonstration of work on the light sense; teaching of physiologic optics.

DRS. VERHOEFF and TERRY. Demonstration of pathological slides.

DRS. DERBY, CHANDLER and MISS O'BRIEN. Significance of the light sense, and a demonstration of the methods by which it may be tested.

LUCIEN HOWE—2. Ophthalmic ergograph, writes automatically the story of ocular fatigue and relation of this fatigue to "eye strain."

H. P. MOSHER—2. Mosher-Toti lachrymal sac operation; demonstration on cadaver.

P. E. MELTZER. Anatomical exhibit of temporal bone specimens.

Wednesday

H. P. MOSHER—2. Laryngological demonstration: Casts of the adult œsophagus; wet specimens showing the œsophagus at birth; cadaver demonstration of the Mosher-Toti lachrymal sac operation; teaching methods used in post-graduate instruction in laryngology.

C. B. FAUNCE—2. Exhibition of temporal bone specimens.

Thursday

G. S. DERBY—2. Ophthalmological demonstrations: Active research, demonstrations of what the pathological laboratory is doing and has done in the past; demonstration of work on the light sense; teaching of physiologic optics.

DRS. VERHOEFF and TERRY. Demonstration of pathological slides.

DRS. DERBY, CHANDLER and MISS O'BRIEN. Significance of the light sense, and a demonstration of the methods by which it may be tested.

LUCIEN HOWE—2. Ophthalmic ergograph, writes automatically the story of ocular fatigue and relation of this fatigue to "eye strain."

H. P. MOSHER—2. Demonstration of methods in post-graduate teaching of laryngology.

O. R. LOURIE—3. Exhibition of temporal bone specimens.

Friday

Conferences in otolaryngology and ophthalmology from 9 to 12.

CARNEY HOSPITAL

Tuesday

W. S. LIEBMAN—9. Eye operations and demonstration of cases; X-ray localization and magnet extraction of foreign bodies.

Wednesday

E. D. HURLEY and W. S. LIEBMAN—9. Eye operations and demonstration of cases.

Thursday

W. S. LIEBMAN and H. BORNCHOFF—9. Eye operations and demonstration of cases.

Friday

W. J. SHEEHAN and F. G. MINITER—2. Otolaryngological clinic.

ST. ELIZABETH'S HOSPITAL

Tuesday

W. T. HALEY—9. Mastoid and tonsil cases.

Wednesday

P. S. MCADAMS—9. Enucleation of the eye.

J. BURNS—9. Tonsillectomy.

Friday

W. T. HALEY—9. Frontal sinus operation.

J. BURNS—9. Mastoid operation.

W. T. HALEY—2. End-results in radical sinus operations.

NEW ENGLAND HOSPITAL FOR WOMEN AND CHILDREN

M. N. KLEINERT and I. D. KERR—9, Tuesday and Wednesday. Ear, nose, and throat clinic; operations and demonstration of cases.

BOSTON CITY HOSPITAL

J. J. CORBETT—9, daily. Eye clinic.

CARNEY HOSPITAL

E. D. HURLEY—9, daily. Eye clinic.

BETH ISRAEL HOSPITAL

L. V. FRIEDMAN and L. ARKIN—9, daily. Nose and throat clinic.

CAMBRIDGE HOSPITAL

N. S. BACON and E. J. BUTLER—9, Thursday. Nose and throat clinic.